July 1983 USA $4.00

80micro

A WAYNE GREEN PUBLICATION

the magazine for TRS-80* users

Language Land

Not All Roads Lead to Basic

Introducing:
Our Model 100 Bonus Section

Plus
Inside Lobo's Max-80
Be Your Own Weatherman
Secrets of the Model II
The CoCo/Epson Connection
Where to Buy CoCo Utilities

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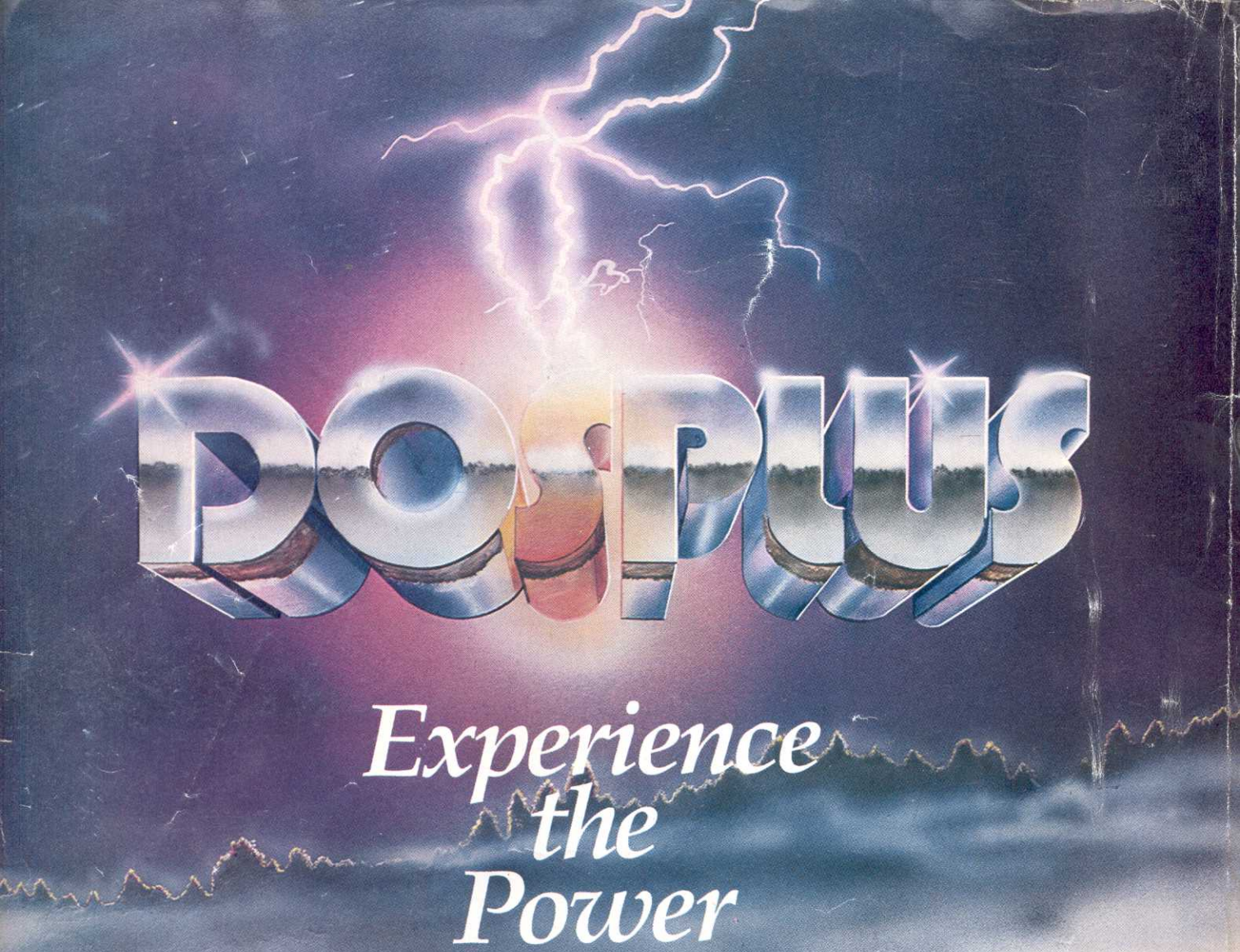

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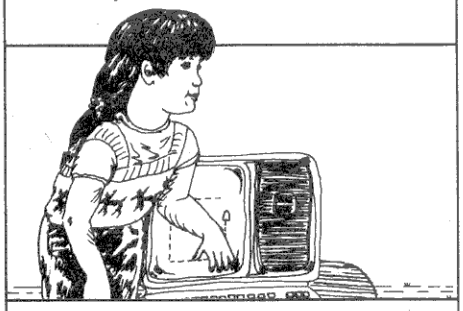

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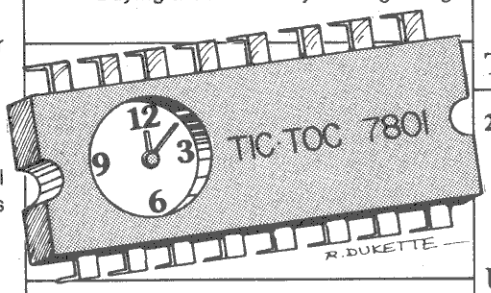

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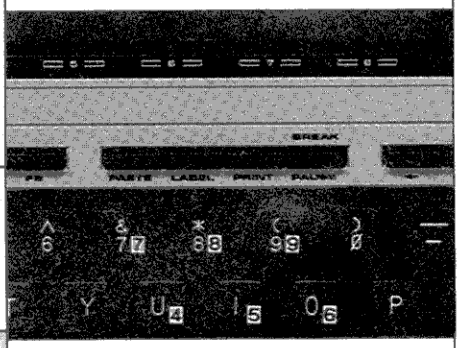

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80 formats its program listings to run 64-characters wide, the way they look on your video screen. This accounts for the occasional wrap-around you will notice in our program listings. Don't let it throw you, particularly when entering assembly listings.

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Cover by Bruce Stephenson

REMARKS

by Wayne Green

The 100—a true portable

With a minimum of fanfare, Radio Shack has announced its new portable computer. This one is really a portable, unlike what are now being termed "transportable" computers such as the Osborne and Otrona.

The 100 is a bit more bulky and heavy than the Sony Typecorder, but it also is much more flexible. Despite the extra weight, I think I'll be shifting my portable writing to the 100 and leaving the Typecorder behind. Pity, because after a year and a half Sony is finally getting around to both updating the Typecorder and lowering its cost ($700).

A couple of years ago I sat down and thought over the features that a portable computer should have. I wrote about it at the time...and also was serious enough about the idea to get together with a manufacturer of microcomputers and go over the proposed design with him with an eye to getting involved in some way with marketing the unit.

About the only major difference between my design and the 100 is that I included a microcassette recorder for saving extra programs and data. The Typecorder has one built in and it is incredibly useful. It can hold 100 or so pages of material...and even record audio, if needed. This is handy for times when there are instructions to an assistant about the next letter to be printed.

The Typecorder has an extra feature over the 100 that has *not* been useful. This is a steno function that creates whole words just from the stroke of a letter key and then the steno key. I suppose that once you have the Typecorder vocabulary memorized this is a time saver...but, being lazy, I've never managed to use this function. It also has a bunch of common word endings... probably useful when a steno is trying to keep up with dictation.

The 100 has both Basic and a word-processor program resident in ROM (that's computerese for being built into the machine). It's nice not having to load a word-processor program to start using the 100 as a typewriter.

The main thing that stopped me cold in developing my version of the 100 was the liquid crystal screen. This LCD unit is the largest I've seen in captivity, with 15,360 dots on the screen...allowing 40 characters per line for eight lines. Each character is made up of a block of dots six wide by eight high (6×8). This allows for the use of a wide variety of graphics characters and special characters. There are special accented characters for just about any language: arrows, little stick men, and so on.

The Sony Typecorder's LCD is just 40 characters wide and one line, seriously limiting what you can read at one time. It works on an 80-character width line, so the display only shows a half line at a time. The 100, on the other hand, displays a 40-character line, but will print whatever length line you select...such as 80, which is standard for letters. I expect Radio Shack had the LCD unit developed for them, as even my visits to the Asian trade shows have not let me see one of that size before. That's one of the great benefits of being able to dedicate a few million dollars to a new product.

The built-in modem, complete with automatic dialing, is right on. With the Typecorder you have to dial your number and then use an accessory modem unit...a small one, to be sure, but still an extra gadget to be carried around. And the Typecorder is an originate-only modem, so you are able to dump messages over the phone, but not get 'em. With the 100 you are all set to run up your phone bill via CompuServe or The Source.

The rush to market the 100 left behind some of the necessary cables and extension cords but they should be out by the time you read this...along with a new rash of supporting software and accessories. The jackpot has been loaded for small firms to add to the 100.

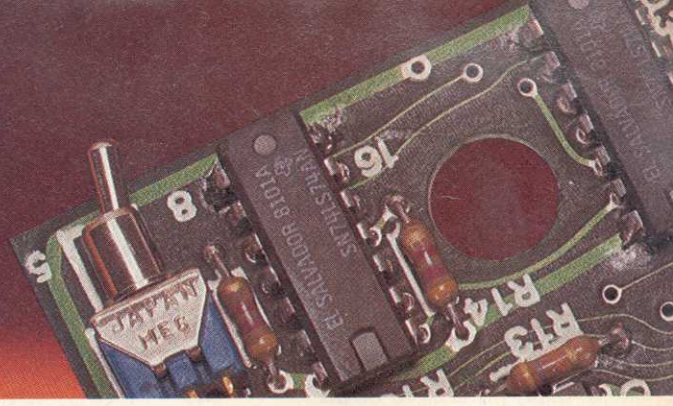
Some firm may come out with new key tops for the computer that will show the graphics and special characters engraved on the sides of the keys, much as the Japanese put their Kanji characters on the side of some keyboards. We don't use very many accents in English, but it would be nice to be able to actually print resume, San Jose, attache, naive as they should be and not be limited by our typewriter. Picky, picky, but their lowercase "i" with the two dots over it is not right. The "i" in that case is not supposed to be dotted with one dot... and then the two more dots over it. Tsk, tsk, how naive of them. Oddly enough, the instruction book shows the character correctly; it's just on the LCD screen that it's wrong—some programmer in Japan probably—and it got missed right along the line.

Well, even with an odd umlauted "i," I'll be using the 100 for writing letters, memos, and editorials for a while.

You know, Epson came close with their HX-20. It's a nice unit too, but the lack of the programs in ROM, the smaller 20-character by four-line LCD screen, and the need for an external modem lessened its usefulness. My test unit came without a cassette recorder built in, so there was no convenient way of saving programs or entering them. Nor were there any of the needed programs available from Epson...or any other sources. And the computer was based on a new microprocessor chip that was not able to directly run programs written for other chips.

Once there are some programs to run on the HX-20—and they have the more important ones in ROM, right in the machine—Epson may be able to give Radio Shack some serious competition. The larger LCD screen is going to push out the tiny printer on the HX-20,

THE SWITCH



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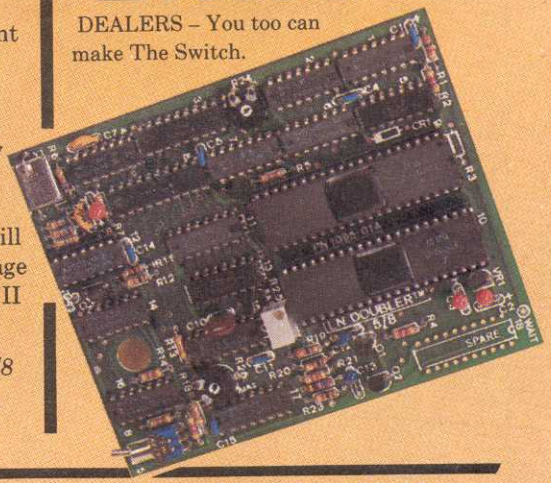

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which won't be a large loss.

Most applications these days call for a printer capable of putting out letter-sized pages with 80-column printing. I think that the quality of the dot-matrix type on the Epson MX-80 has brought a lot of businessmen around to being able to accept that type of printer for business letters. The time was when nothing less than an IBM Selectric-quality character was really usable for business.

Just as I've found the Typecorder of enormous use on my travels, I think other businessmen will want to be able to put the time normally wasted in air terminals and on planes to use. People who travel by train or bus in commuting to work will want to take advantage of wasted time to write memos and letters. I see a large business ahead for this type of computer.

Salesmen will be able to call in from their motel in the morning and get the latest information for their sales calls during the day... arriving with information on whom to see, notes from previous meetings, data on orders and payments, quality problems, and so on. The better-armed a salesman is, the more effective he is going to be.

"The better-armed a salesman is, the more effective he is going to be."

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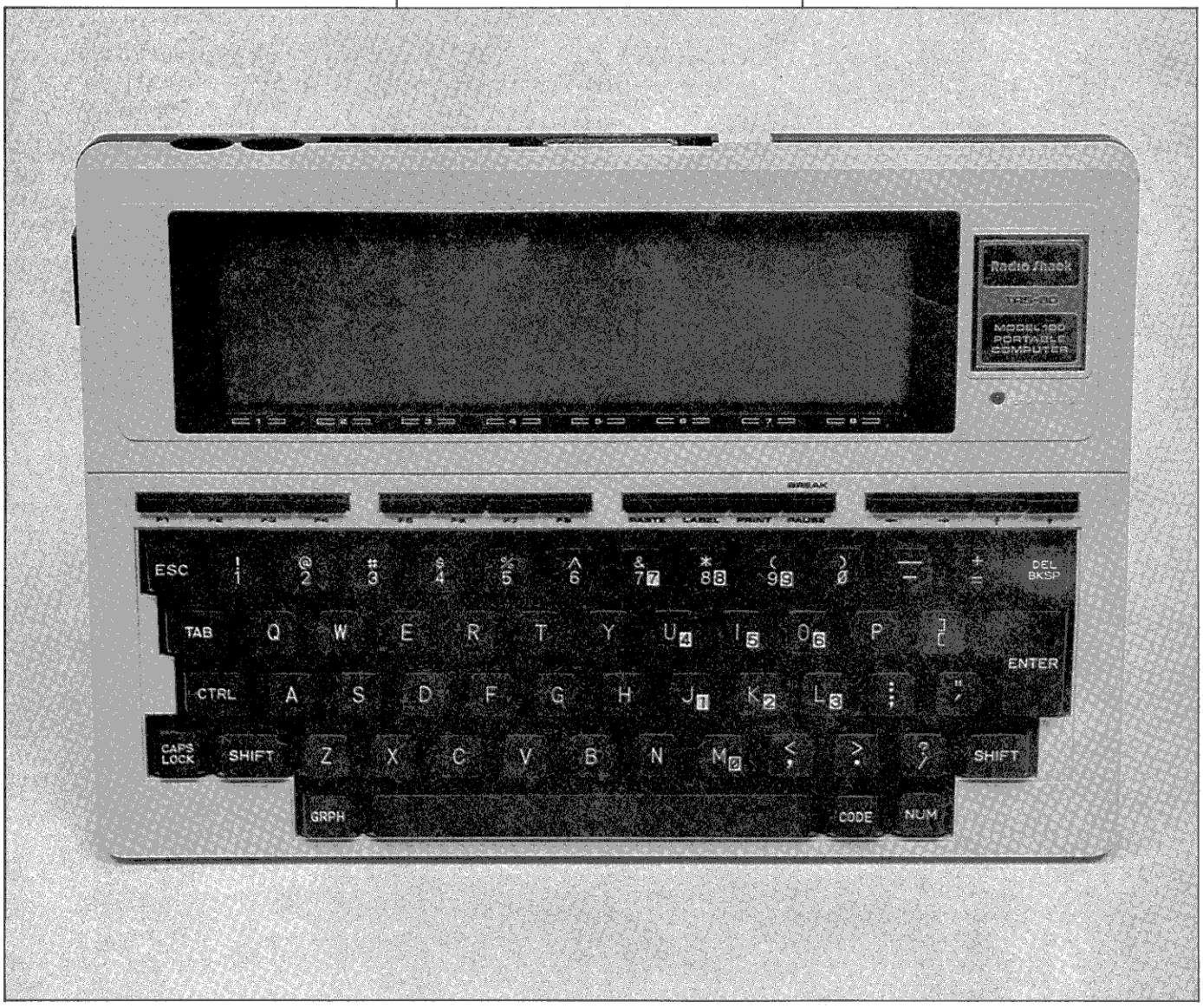
Executives will be able to travel more when they take along this communications system. They'll be able to check with the home-office computer and get a dump of memos on important mail, meetings, and questions needing a decision. They'll be able to respond immediately... or write up the answers and have the computer send them back later... along with any letters typed during the trip. This is going to increase efficiency and productivity. ■



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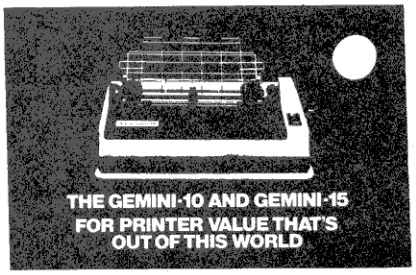

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The 100: a machine with duende

The microcomputer industry is fast being overrun by snake oil artists looking for a quick kill. As a result, users are becoming increasingly cynical about the hyperbolic fanfare surrounding many new products. Today manufacturers have to market something truly outstanding before they receive praise that might be considered unqualified.

All the more remarkable, then, is the nearly universal acclaim for Tandy's new Model 100. Everyone we've spoken to or whose comments we've read agrees: this is a well-crafted machine, one that gives Tandy an early lead in the burgeoning lap-sized portable market.

What makes the Model 100 so good? Of course, it's packed with useful and intriguing features, which we examine fully in our review beginning on p. 158. But the qualities that impress us most go beyond simple hardware and software. This machine has what the late columnist George Frazier might have called duende.

Duende is a certain quiet, stylish charm that imbues a person or object with almost instant appeal. The 100 might be just another plastic box full of silicon chips, yet Tandy has somehow managed to give it a distinct personality that separates it from the competition. Put a Model 100 in the average user's lap, and he's captivated.

We are also impressed by the fact that the Model 100 is designed for both the end-user and the programmer. The neophyte businessman can be up and running in a matter of hours, and still expanses of uncharted territory await the experienced, curious programmer. Should these two factions develop a mutually profitable relationship, the potential exists for a substantial support industry.

We're convinced that the Model 100 is going to be a success. In fact, we're so sure that starting with this issue we're giving the 100 its own section, called C•Notes, starting on p. 156. Along with the review, this month's articles include a news analysis of the 100's position in the microcomputer market and a software starter package.

The starter package includes two originals (Gas and Oil Mileage and Traveling Expenses) and five conversions of programs previously published in *80 Micro* (Punch Out, Itinerary 100, The Final Notice, Monitor 100, and The Rule of 78). All have been selected to take advantage of the Model 100's portability, and all but one fit into 8K.

Future editions of C•Notes will include utilities, games, and applications for the Model 100. Do you think you have something of interest to other Model 100 users? If so, send a query letter to C•Notes, *80 Micro*, Peterborough, NH 03458.

* * * * *

Our Model I/III owners will be glad to know that the material in C•Notes is in addition to our regular offerings. They'll also be happy to hear that with the advent of *HOT CoCo*, we're phasing out our coverage of the Color Computer. The reason for this move is simple: we don't have the room to adequately cover both systems. The vast majority of you own Model I's and III's, and we feel strongly that the bulk of our material should fill your needs.

If you're a Color Computer owner, don't despair. You'll be able to transfer your subscription from *80 Micro* to *HOT CoCo*.

—E.M.

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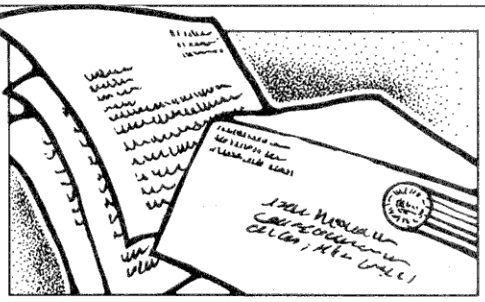
INPUT



Apology to Holmes

"Muscle Micros" (*80 Micro*, April 1983, p. 82) refers to the Holmes Sprinter III speed-up kit as the 4 MHz Holmes-Brenner speed-up. This is entirely incorrect. We checked with both B.T. and Computex, and both refer properly to this product as the Holmes Sprinter speed-up or the Sprinter III. They know nothing of anyone named Brenner.

James A. Clemans
Holmes Engineering
3555 South 3200 West
Salt Lake City, UT 84119

We've never heard of the fellow, either, and have no idea how he slipped into the article. Sorry about that.—Eds.

Color Kudos

Scott Norman's Color Key column and his article on FLEX (*80 Micro*, March 1983, p. 30 and p. 101) struck just the right notes and exhibited just the right orientation for me and, I suspect, many other Color Computer owners.

I seem to have traveled a portion of the road Mr. Norman has traveled. I've purchased C.C. Writer, Color File, Spectaculator, and Telewriter. My next big acquisition will be a disk system. Thanks to his FLEX article, the road ahead has begun to seem less confusing.

Bard S. Crawford
9 Patriots Drive
Lexington, MA 02173

DLOADM Bug

The mystery surrounding the DLOADM command in Extended Color Basic as discussed in "CC DLOAD" (*80 Micro*, March 1983, p. 140) is easily cleared up. A bug in the ROMs prevents a DLOADM command from being recognized as such.

For a simple fix, use CLOSE #-1 : POKE &H78, ASC("M") : DLOADM "filename," baud, offset. Baud has the same value as DLOAD and offset has the same value as CLOADM.

As with CSAVEM and CLOADM, there is no DLOADM token, just DLOAD followed by an ASCII M. On encountering a DLOAD or DLOADM command, the next byte from the Basic program loads into the A register (an ASCII M if the command was DLOADM). This first step is common to most commands and occurs before jumping to the DLOAD routine.

Second, a subroutine closes the cassette file if it's open (DLOAD or DLOADM needs the buffer). Then the A register is checked to see if it contains an ASCII M, and a flag byte is set or cleared accordingly.

Unfortunately, the second step causes the contents of the A register to change; consequently, the third step does not recognize DLOADM. This bug could have been corrected by exchanging the second step for the third.

Ralph Fox
4212 Wadsworth Ct. #102
Annandale, VA 22003

The Copy Controversy

After PowerSoft's statement on piracy (*80 Micro*, April 1983, p. 24), I'm sure the controversy is not going to die down, and I want to add my comments to the fray.

PowerSoft failed to address what are to me the two uppermost issues in this discussion: It is undeniably hypocritical to sell a program that copies other vendors' uncopyable programs but cannot be copied itself, and it is inconvenient for me to be prevented from including utility programs on my regular working disks as I see fit.

I am an honest computer user and will not accept or give away copyrighted programs. PowerSoft has the right to do whatever they want with their programs, but I will continue to exercise my influence as a consumer by never buying protected software.

John Ratzlaff
Mount Pisgah Academy
Candler, NC 28715

MULTIDOS Mess

I am pleased with my recent purchase of MULTIDOS for my Model I with a Percom Doubler I. It's compatible with most of my software, except the new Radio Shack SuperScripsit.

After I copied SuperScripsit to my MULTIDOS disk, everything worked, but the errors displayed at the bottom of the screen appeared as garbage. MULTIDOS apparently used the logical record length from the directory when opening files in contrast to TRSDOS, which specifies it in opening the file.

To fix the problem you must zap relative byte 4 of the directory entry for ERRORS/CTL to 40 hexadecimal, the logical record length that SuperScripsit expects to see.

Doug Lyons
P.O. Box 741
Bucksport, ME 04416

Tape Reload

You included some misinformation concerning the Radio Shack XRX III modification in the February Reload 80 column (p. 416).

The XRX III modification does not defeat high-speed tape loading by KWICOS. Double-speed operation through the XRX at a performance level superior to the standard 500 baud is a principal development goal met for all Model I KWIK programs; KWICOS, KWIKIT, KWINK, KLOAD, and KNET allow tape operations at 1,000 baud even with the XRX modification.

It is only for 1,500- to 3,000-baud cassette operations that you must disable the modification by a simple change in the connection of two wires.

The XRX modification itself is a hardware attempt to make a brute force compensation for an error in the original Model I ROM; it is a temporary fix. The dismal cassette performance is not due to some flaw in the port circuitry. On the contrary, the original circuits can reliably handle much higher than 500 baud.

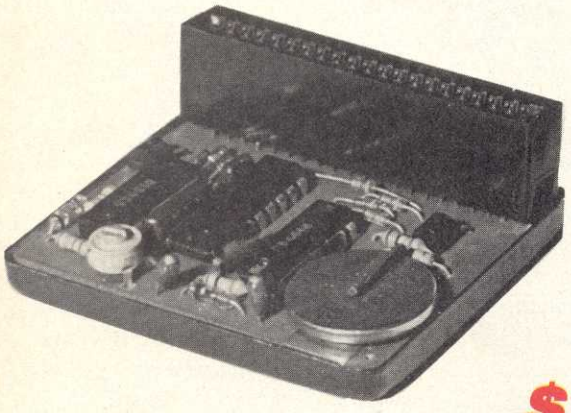
The cassette loading on the newer machines (those that print MEM SIZE? instead of MEMORY SIZE?) is better than the early models. This is because the ROM routines are corrected, not because the XRX was incorporated into the hardware.

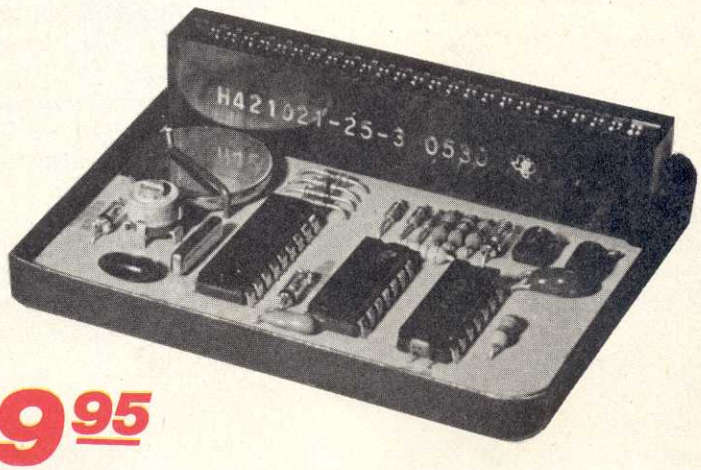
Later Model I units should not have the XRX, and should not need altera-

NEWCLOCK-80

MODEL I

MODEL III





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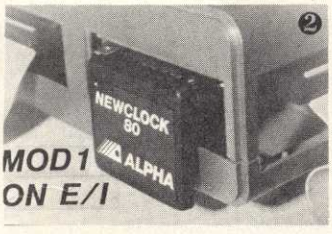

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Compatibility: Newclock-80 is compatible with any operating system, including DOSPLUS, NEWDOS, LDOS. With its fully decoded circuitry it will work with any other hardware you may own. Bus expanders are available.

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The Software: Newclock-80 is as easy to use as it is to install. -"SET", a Basic program, is used only once to set the time and date and select 12 or 24 hour format. -"TIMESTR", also in Basic, patches your computer "TIME$" function to read Newclock-80. It also adds "TIME$" to keyboard-only systems, a short routine is simply "poked" into low memory.

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Page Number News

"Number Your Program Listings" (*80 Micro*, Anniversary Issue 1983, p. 208) provides an excellent way to page-list Basic programs. It works well with a Model III if you change lines 810 and 850 to IN A,(0F8H) and OUT (0F8H),A, respectively.

It is also helpful to adjust the number in line 780 to fit the length of paper you're using.

Dan Ramsey
NTTC Corry Station Box 2266
Pensacola, FL 32511

Space Calculation

Program Listing 1 is a simple program that might be of interest to woodworkers, carpenters, and cabinet makers. It computes the interval length between spindles for a railing, and accumulates this distance for complete accuracy, printing out in inches and thirty-seconds of an inch.

Often a woodworker has to measure the space between spindles, the rise and run of stairways, and so on. Usually the cumulative measurement does not equal the original length desired, so it is necessary to hedge on each measurement until the spacing is satisfactory. This program solves the difficulty.

Carl Eggstaff
P.O. Box 3773
Incline Village, NV 89450

80 ALERT

Occasionally, 80 Micro *receives letters from readers who have had difficulties with our advertisers. Most of the time, these problems are resolved to the satisfaction of all parties, but some problems appear to be insoluble.*

As a service to readers and advertisers alike, 80 Alert will pinpoint distributors who cannot be reached, by readers or by our advertising department, for customer service. Anyone who has current information about a manufacturer or distributor mentioned in the column is welcome to write and update our data.

Intersoft Unlimited went out of business effective Dec. 1, 1982. Anyone interested in their C compiler (reviewed in *80 Micro*, February 1983, p. 198) should contact: Michael Spohnholtz, c/o MAS Enterprises, 2623-151st Place N.E., Redmond, WA 98052. Version 2.5 has been completed.

AIDS III Free?

Boy, am I ticked off! Two years ago I bought a copy of AIDS III and CALCS IV from Meta Technologies. I paid full price for these programs. Now along comes the March 1983 issue of *80 Micro* (p. 136) and I find an upgraded version of AIDS III given away free.

It makes me wonder why I was so honest. I should have made copies of the program for my friends—after all, it's now free to anybody. Also, why wasn't I informed that an upgrade was available? What is the point of being a loyal customer?

If I were advertising programs similar to AIDS III or The Creator in your magazine, I'd be mad as hell. It's hard to compete against free giveaways.

K.D. Miller
Toronto, Canada

SofTrends' Side

*With great interest, I've followed the response to Bruce Tonkin's article, "The Creator" (*80 Micro, *January 1983, p. 74), and to my articles about the AIDS programs (*80 Micro, *March and April 1983, p. 136 and p. 168). As expected, these articles have generated a highly polarized reaction. We have been alternately applauded and berated by owners of the AIDS system.*

I have been particularly struck by our detractors' lack of understanding. I'd like to explain SofTrends' reasons for risking the anger of thousands of satisfied AIDS users.

The irony of AIDS winning three 80 Micro *Readers' Choice Awards (*80 Micro, *January 1983, p. 394) is that it had been out of commerical distribution for more than half a year. Historically, whenever a new release of AIDS is made available, virtually all current owners upgrade their systems within six months.*

It should be made clear that the source code for these programs is not that of an enhanced version. It is the original, remarked, uncompressed source with minor changes for clarity and legal protection. Its published form runs slower and uses more memory than its commercial equivalent.

Over the years, hundreds of users have asked for the remarked code so they could make custom modifications. This is the first time it has been released. A number of the routines within the older AIDS are valuable examples of advanced programming in Basic—certainly of interest to some of 80 Micro*'s readers.*

I'd like to address the morality of giving away a product for which thousands of people have paid good money. In 1972, I purchased a four-function calculator for $295. Four years later, rather than pay $50 to have it repaired, I replaced it with an eight-function calculator that cost $20.

```
10 REM A PROGRAM TO COMPUTE THE SPACE DISTANCE BETWEEN SPINDLES
20 REM FOR A RAILING, OR THE RUN AND RISE OF A STAIRWAY
30 REM INPUT AND OUTPUT IS IN INCHES AND 32NDS OF AN INCH
40 CLS
50 PRINT "TOTAL LENGTH IS"
60 PRINT "INPUT INCHES": INPUT A
70 PRINT "INPUT 32NDS": INPUT B
80 PRINT "NUMBER OF INTERVALS IS": INPUT C
90 D=B/32: E=A+D
100 PRINT "TOTAL LENGTH IN DECIMALS IS" E: F=E/C
110 PRINT "INTERVAL SPACING IS" F "INCHES":G=F
120 H=FIX(G):P=(G-H)*32+.5:Q=FIX(P)
130 PRINT H "INCHES" Q "32NDS"
140 Z=G:G=G+F:IFG<EGOTO120
150 PRINT "TOTAL LENGTH ACCUMULATED IS" Z "INCHES"
160 GOTO160
```

Program Listing 1

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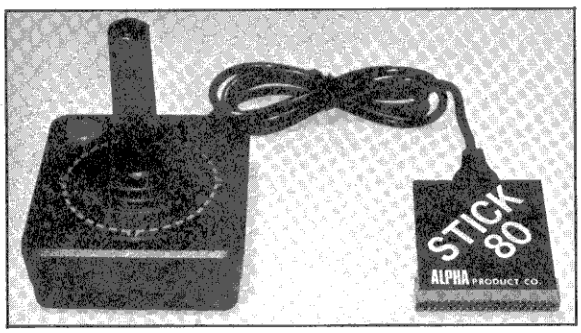

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I have never regretted this decision, nor countless others, to obtain a high-technology product while risking short-term obsolescence. The justification for such a purchase cannot be based on crystal-ball prognostications. That calculator saved me scores of hours of effort. Even at minimum wage, it was worth the price.

Finally, a word to SofTrends' competitors. If you can produce and deliver a better product at a lower price, do it. I'll buy it, I'll use it, I might even sell it. If you can't, maybe you ought to try giving it away.

Robert A. Fiorelli
President
SofTrends Inc.
26111 Brush Ave.
Euclid, OH 44132

SuperScripsit Serial

I had problems trying to get SuperScripsit to work with my letter-quality serial printer, a Perkin-Elmer Carousel 350, and my Model III. My printer did not automatically add a line feed after each carriage return, and was incapable of being adjusted to do so.

The detailed documentation carefully stated that when line feeds are suppressed, byte number 98 in the serial driver equals 00. You must change byte number 98 to 0A, the ASCII code for a line feed, to ensure an automatic return.

Rodney B. Murray
Kenilworth #1412
Philadelphia, PA 19144

Sort Support

In response to my article "Another Sort of Sort" (*80 Micro*, December 1982, p. 276), a reader, Peter Weygang, has provided a simple and interesting method of printing the results of a position or count sort without using a dummy record. If you like to experiment with sorting routines, I suggest you give it a try.

Make the changes shown below to Program Listing 2 in my article.

- Delete lines 290–340 and line 410.
- Add: 290 FOR J = 1 TO 11
  300 X(C(J),I) = J
  310 NEXT J
  425 T = X(I,PR)
- Change the 10 in line 420 to 11.
- Substitute a name and address for the "AAA,AAA,AAA", such as LEWIS,HARRISBURG,PA in line 1000.

When you incorporate these changes, the print should look the same as under the previous program.

A disadvantage of the position sort and print as shown is that it requires a complete re-sort of all data each time you add a record. Since I wrote the article for a data base where complete re-sorts could be avoided, I selected the dummy record approach in its stead. This leads to the merge sort used in that application.

Karl L. Townsend
103 Knollwood Drive
Lansdale, PA 19446

The Model I and the LP VII

Serge Calmettes' article "LP VII Screen Output" (*80 Micro*, February 1983, p. 252) does not contain a routine for the Model I with Radio Shack's lowercase modification.

Since lowercase changes video RAM, when Mr. Calmettes' program looks at alphanumeric characters in video RAM, it sees numbers 1–26 instead of 65–90.

Program Listing 2 is a revised version of his program that works on the Model I equipped with lowercase.

Steven Maguire
481 Quist Drive
Port Richey, FL 33568

Apple Adjustments

I have a rather unique application for O'Connor's "Seeker" program (*80 Micro*, March 1983, p. 272). It converts PRINT to LPRINT, but is also useful for converting TRS-80 Basic to Apple Basic and vice versa.

I extended O'Connor's list to include the standard Apple words, and by transferring files from the Apple at my office to my Model I at home, I can edit or convert the Apple programs (except for graphics) and even return them to the office machine.

My university is operating an educational net for science teachers. Since some schools have Apples and others TRS-80s or IBMs, we can convert one kind of program into another and file it on the mainframe with the proper designation for the final user. I wish someone would write a good translator, but for now we are converting by hand.

I'd like to encourage your advertisers to include non-Tandy computers (not just peripherals) in their ads. Many of us have access to more than one kind of machine, although we concentrate on the Tandy equipment.

David A. Mathewes
420 Long Branch Road
Cullowhee, NC 28723

See 80 Micro, *June 1983, p. 78, for an Apple emulator program for TRS-80 Z80 microprocessors.—Eds.*

Better Basic Lisp

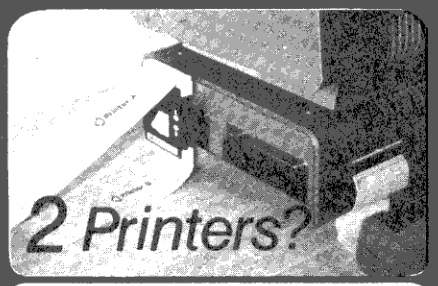
Randy Beer's Basic Lisp interpreter (*80 Micro*, March 1983, p. 176) is su-

```
50000 Y=0:FORV=15360TO16383STEP64
50010 P1=0:FORI=0TO63:P=PEEK(V+I):GOSUB60000:IFP<33ORP>126THEN
P=0
50020 P1=P1+P:NEXTI:IFP1=0GOTO50060
50030 FORI=0TO63
50040 P=PEEK(V+I):GOSUB60000:IFP<32ORP>127THENP=32
50050 LPRINTCHR$(P);:NEXTI:LPRINTCHR$(26);
50060 LPRINTCHR$(18);
50070 FORW=1TO3
50080 P1=0:FORX=0TO127
50090 P=POINT(X,Y):P1=P1+P:NEXTX:IFP1=0GOTO50150
50100 FORX=0TO127
50110 P=POINT(X,Y):IFP=-1THENP=255:GOTO50130
50120 P=128
50130 LPRINTCHR$(P);CHR$(P);CHR$(P);
50140 NEXTX
50150 LPRINTCHR$(10);:Y=Y+1:IFY=48THENRETURN
50160 NEXTW
50170 LPRINTCHR$(30);
50180 NEXTV
50190 RETURN
60000 IFP>47ANDP<61THENRETURNELSEIFP<=26THENP=P+64
60010 RETURN
60020 RETURN
```

Program Listing 2

NOW MODEL I AND MODEL III!

Now Model III users can take advantage of the ALPHA I/O system too. Our new MOD III/I BUS CONVERTER allows most port based Model I accessories (such as our ANALOG-80, INTERFACER 2 and INTERFACER-80) to connect to the Model III bus. MOD III/I BUS CONVERTER, complete with all connectors, only $39.95.



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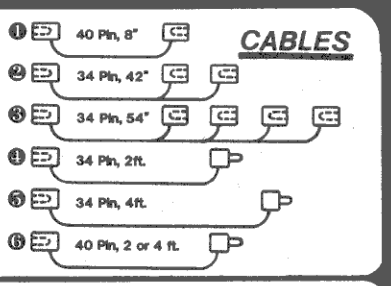

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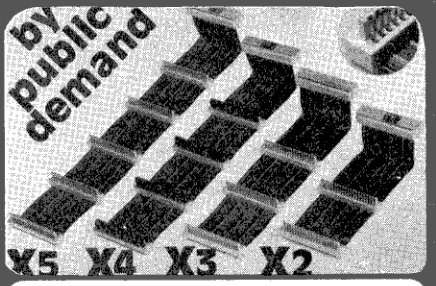

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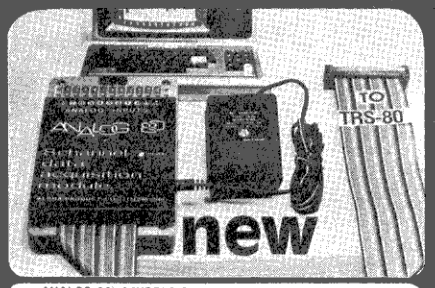

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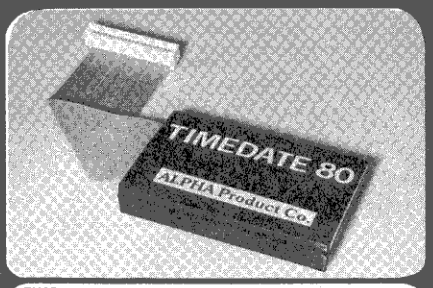

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GREEN SCREEN WARNING

IBM and all the "biggies" are using green screen monitors. Its advantages are now widely advertised. We feel that every TRS-80 user should enjoy the benefits it provides. But **WARNING**: all Green Screens are not created equal. Here is what we found:

- Several are just a flat piece of standard colored Lucite. The green tint was not made for this purpose and is judged by many to be too dark. Increasing the brightness control will result in a fuzzy display.
- Some are simply a piece of thin plastic film taped onto a cardboard frame. The color is satisfactory but the wobbly film gives it a poor appearance.
- One "optical filter" is in fact plain acrylic sheeting.
- False claim: A few pretend to "reduce glare". In fact, their flat and shiny surfaces (both film and Lucite type) ADD their own reflections to the screen.
- A few laughs: One ad claims to "reduce screen contrast" Sorry gentleman but it's just the opposite. One of the Green Screen's major benefits is to increase the contrast between the text and the background.
- Drawbacks: Most are using adhesive strips to fasten their screen to the monitor. This method makes it awkward to remove for necessary periodical cleaning. All (except ours) are flat. Light pens will not work reliably because of the big gap between the screen and the tube.

Many companies have been manufacturing video filters for years. We are not the first (some think they are), but we have done our homework and we think we manufacture the best Green Screen. Here is why:

- It fits right onto the picture tube like a skin because it is the only **CURVED** screen **MOLDED** exactly to the picture tube curvature. It is Cut precisely to cover the exposed area of the picture tube. The fit is such that the static electricity is sufficient to keep it in place! We also include some invisible reusable tape for a more secure fastening.
- The filter material that we use is just right, not too dark nor too light. The result is a really eye pleasing display.

We are so sure that you will never take your Green screen off that we offer an unconditional money-back guaranty: try our Green Screen for 14 days. If for any reason you are not delighted with it, return it for a prompt refund.

A last word: We think that companies, like ours, who are selling mainly by mail should: •list their street address •have a phone number (for questions and orders) •accept CODs, not every one likes to send checks to a PO box •offer the convenience of charging their purchase to major credit cards. How come we are the only green screen people doing it?

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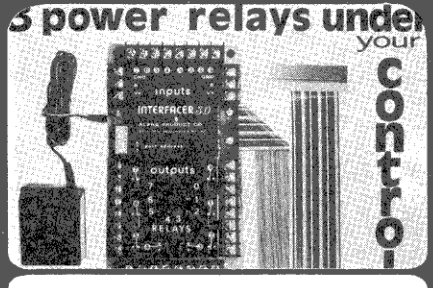

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perb, so I want to suggest something to improve it. To use the interpreter, you have to type at the speed of processing each character, which is not very fast.

I modified the input routine to operate on buffered input—to accept a line of text at a time rather than a character at a time.

Several advantages result from this method. You can correct a line with the backspace key before you press return. You can also make better use of your time. Type in a line, press enter, and go eat lunch while the machine digests the line (it takes a while).

If you have an operating system that allows redirecting input from the disk instead of the keyboard, it's possible to simulate a mainframe environment.

Whip out your text editor and produce some Lisp source code. Then start up the Lisp interpreter, feeding it input from the disk file previously created. Depending on the length, you might want to come back in the morning.

The modification below is for a Model I disk system or a Model III. You can convert it to Level II with a little effort.

```
23 PS = 1: BUF$ = "":              REM MS 3/82
90 PS = PS + 1: if PS > len (BUF$) then line input BUF$: BUF$ = BUF$ + " ":
PS = 1:                            REM MS 3/82
95 A$ = mid$(BUF$, PS, 1): KK = asc(A$):
return:                            REM MS 3/82
```

Michael J. Sorens
1414 Davidson Road
Abington, PA 19001

Who Are the Real Pirates?

A year ago, before I bought my computer, I would have been on the side of the software writer. Now with about $1,000 worth of software, my sympathy leans toward the pirate.

I consider myself, for lack of a better term, a computer user. I don't like to patch, PEEK, POKE, convert, delete, and plead with a purchased program to try to get it to do what I thought the ad said it would do.

I use the computer to keep the books for five small corporations, appraise real estate, and do anything else that might help me in my work. I try not to use it to create more work.

My $1,000 investment in software covers about 20 programs, not counting the games and such that come on LOAD 80 tapes. I consider two programs excellent, and two good. The rest had bugs, poor or no documentation, and needed alterations that were beyond me. Some were so bad that I just reformatted the disks to salvage something out of a bad investment.

I have about $400 worth of software that I feel was worth the money, but somewhere software writers have $600 of my money they didn't earn. I can't help feeling that if a friend showed me a program I liked and let me copy it, I've already paid my dues and wouldn't get too upset about it.

If I order a $100-plus program from someone who advertises as a professional, I expect the software to boot up and run error-free immediately. No PEEKing, POKEing, patching, and pleading.

William E. Sharp
2145 West Ave.
Ocean City, NJ 08226

Scripsit Tips

You can use the standard XFERSYS utility on DOS 1.3 disks to obtain more than the two back-ups allowed by your Model III Scripsit 3.2 disk.

Take an old DOS 1.1 or 1.2 disk with enough room to hold Scripsit, then do an XFERSYS on that old disk in drive one while your DOS 1.3 Scripsit disk is in drive zero.

While updating old DOS 1.1 and 1.2 disks, I used my original DOS 1.3 Scripsit disk because it contained my only copy of the XFERSYS utility. Scripsit started appearing on everything I updated. They were multiplying like rabbits—so many that I had to purge to control the excess population.

Each new Scripsit copy allows as many normal back-ups as you have left on your original.

I was annoyed to find that stock version 3.2 Scripsit reads and writes tapes only at 500 baud. The patch for 1,500 baud is as follows: PATCH SCRIPSIT/CMD (ADD = 5308,FIND = AF321142,CHG = AF320000).

If you still use Scripsit 1.0, try: PATCH SCRIPSIT/CMD (ADD = 5222,FIND = AF321142,CHG = AF320000). You can omit the AF32 if you move the ADD = 2 bytes higher.

Michael M. Meyers
12 Hamilton Ave.
Montclair, NJ 07043

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Error Trap

Two address listings for the South Bay User's Group and one for the Silicon Valley Computer Club (*80 Micro*, Anniversary Issue 1983, p. 526) are inaccurate. You can contact all three groups at: South Bay TRS-80 User's Group, P.O. Box 60116, Sunnyvale, CA 94088.

Michael Nadeau's review of Demon Seed (*80 Micro*, April 1983, p. 56) did not contain the address of the manufacturer, Trend Software. Direct your requests for information or dealer prices to: Trend Software, P.O. Box 741, Bloomfield Hills, MI 48013.

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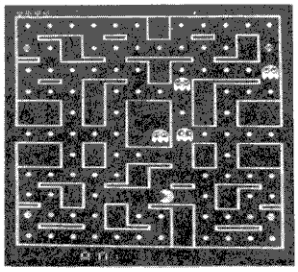


GHOST GOBBLER

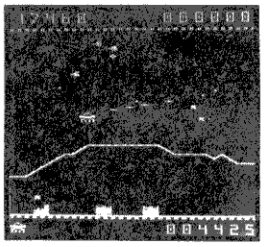
From Spectral Associates, this "Pac" theme game is the best of it's type. Brilliant color, action and sound, just like an arcade gobble your way to glory, but watch for those ghosts! Get in on the wild fun of this game craze now. Tape: $21.95, Disk: $25.95

DONKEY KING

DONKEY KING

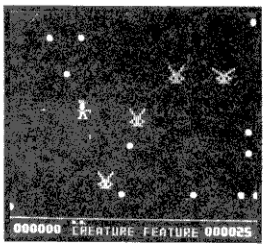
You simply can not buy a more impressive game for your color computer than this new wonder from Tom Mix. The graphics, sound, and animation are all just astonishing! There are four different graphic screens and each is endless fun. Requires 32K. Tape: $24.95, Disk: $27.95

GHOST GOBBLER



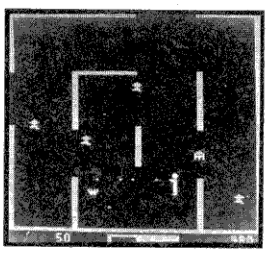
PROTECTORS

There are several good versions of the "Defender" theme available for the CoCo. None, however, rival this one from Tom Mix. No other game matches the detailed graphics and sheer excitement of this top seller. Requires 32K. Tape: $24.95, Disk: $27.95



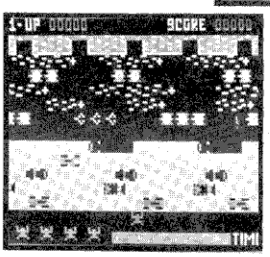
CREATURE FEATURE

From Color Software, comes a lightening swift shoot & dodge the enemy game. It's clever cross between "Robotron" and "Beserk" themes, with bullets flying everywhere. Solid, shoot-em-up-fun. Requires 16K. Tape: $17.95. Disk: $19.95



ANDROID ATTACK

Spectral Associates' very well done "Berserk" type game with some interesting added features. Each cassette contains both the 16K and 32K version. The 32K version has voice output! Plenty of action. Tape: $21.95



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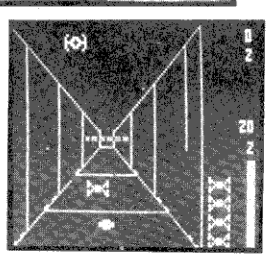

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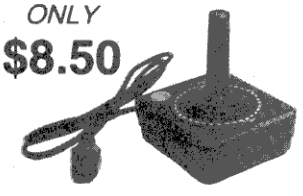

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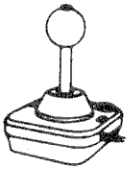

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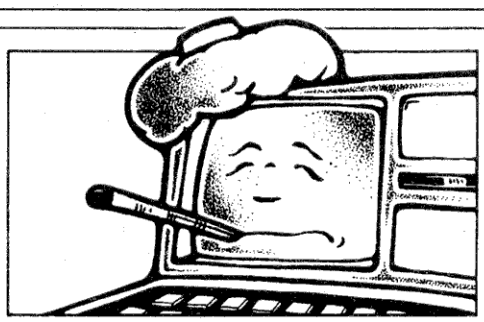

Looking for help

What's the Current Info?

I'm in the military and will be returning to Germany this summer. I presently own a Model II with two printers and plan to buy a Model III before I leave. Will both of these computers operate on the European 220-volt, 50-cycle system? What effect will the 50 Hz patch have on software operation?

If anyone can answer these questions, I'd appreciate hearing from you.

CH(LTC) Bobby G. Allen
8630 Glen Mont
San Antonio, TX 78239

VoxBox Software Wanted

I desperately need the operating software for the TRS-80 VoxBox. All my tapes self-destructed after the 90-day warranty expired. Can someone help?

Scott Korney
915 Vaughan St.
Moose Jaw, Saskatchewan
S6H 5N9

Which is Better?

We recently bought a Model 16 that we're planning to use for college administration purposes. We're having a difficult time deciding whether we should use a stack loader and feeder for word processing envelopes and letters, or whether we should go with continuous-feed letters and envelopes with a stuffer.

Can someone provide us with the advantages and disadvantages of each system? Also, does anyone know where we can get label applicators that would suit our needs?

A. Wayne Lowen
Central Christian College
1111 Urbandale Drive East
Moberly, MO 65270

Program Swap

I'm a Color Computer owner, and I'd like to swap machine-language programs with anyone who's interested.

Harry Sawyer
80 High Oaks Drive
Watchung, NJ 07060

Print Wheel Compatibility?

Does anyone know of a computer other than Radio Shack that makes print wheels compatible with the Daisy II? NEC says that 50 print styles are available for their Spinwriter.

Gary W. Shanafelt
2128½ S. 18th St.
Abilene, TX 79605

Connection Wanted

I'm trying to connect my 16K Color Computer with the PC-100C printer. Does anyone have information on how to do it?

Armando Martinez
Gonzalitos 331 Sur
Monterrey, N.L.
Mexico 64030

What's the Strapping Position?

I would like to increase the memory capacity of my Model I to 16K, but I'm having a difficult time locating proper strapping information for the Z3 strapping position while using NEC ROM.

Can anyone help?

R.L. Fletcher
8131 Via Bonita
Sanford, FL 32771

Do You Have a Map?

I would like to know if anyone has either a memory map for the Model III, or a map of system RAM.

Eric Ewanco
7633 Beckwood Drive
Fort Worth, TX 76112

CoCo Mailings

I'd like to buy an envelope/stationery feeder for my 32K Color Computer that can handle 500–1,000 mailings at a time. Can someone help me?

Terry Moor
P.O. Box 652
Willernie, MN 55090

Orphan Unit

GTE and RCA no longer manufacture or support my GTE NOVAR 5-41 printer, so I now own a $1,000 paperweight. Does anyone know where I can get either service or the schematics for this unit?

John Vinokur
P.O. Box 204
Champlain, NY 12919

Needs Service Manual

I'd like to buy or borrow a service manual for the Shugart 400 disk drive used in the early TRS-80 Model I.

A.A. O'Brien
18 Tirriki St.
Charlestown 2290
Australia

Compatibility Problem

I can't get the high resolution graphics on my Model II to print out on the NEC 8023C printer. Does anyone know of a way to get these two products to work together?

Robert Stockman
10748 100th St.
Alto, MI 49302

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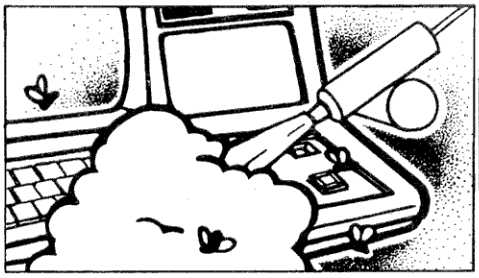


Flaws and fixes

Load 80 LISP Fix

Randy Beer's "LISP: Basically Speaking" program found on the March 1983 Load 80 disk and cassette does not work correctly. The program responds with an error message when instructed to evaluate a list. This is due to an accidental second iteration of line 4500.

To fix this program just delete line 4500 and then look at the listing. Line 4500 should now be in its correct place between lines 4460 and 4600. If it's not, retype the line as found on p. 176 of the March 1983 issue.—*80 Techies*

The Last Fix

The Color Computer version of Richard Ramella's Peg Leg listing (March 1983, p. 28) won't run correctly. To fix the program, you need to add AND POINT (A,B)=8 to statements 600, 620, 640, and 660.

Lyle Jones
427 Pamela
Wichita, KS 67212

Tank-Gun Fix

Larry Becker's "Tank-Gun" program for the Color Computer (August 1982, p. 202) has two bugs in it. The first bug is that line number 1070 needs to have +W added to the end of the line. Without this correction any wind affects only the right tank but not the left tank. The second bug is in line 1030. The variable YB should be changed to YA.

Ron Mix
2020 Chieftain Row
Logansport, IN 46947

Hear and See for the CC

In order for Nancy Modney's "Michael's Game" program (February 1983, p. 208) to run on the 16K Color Basic Color Computer you need to delete line 60 and change line 220 to:

```
220 FOR Y=0 TO 30:NEXT Y
```

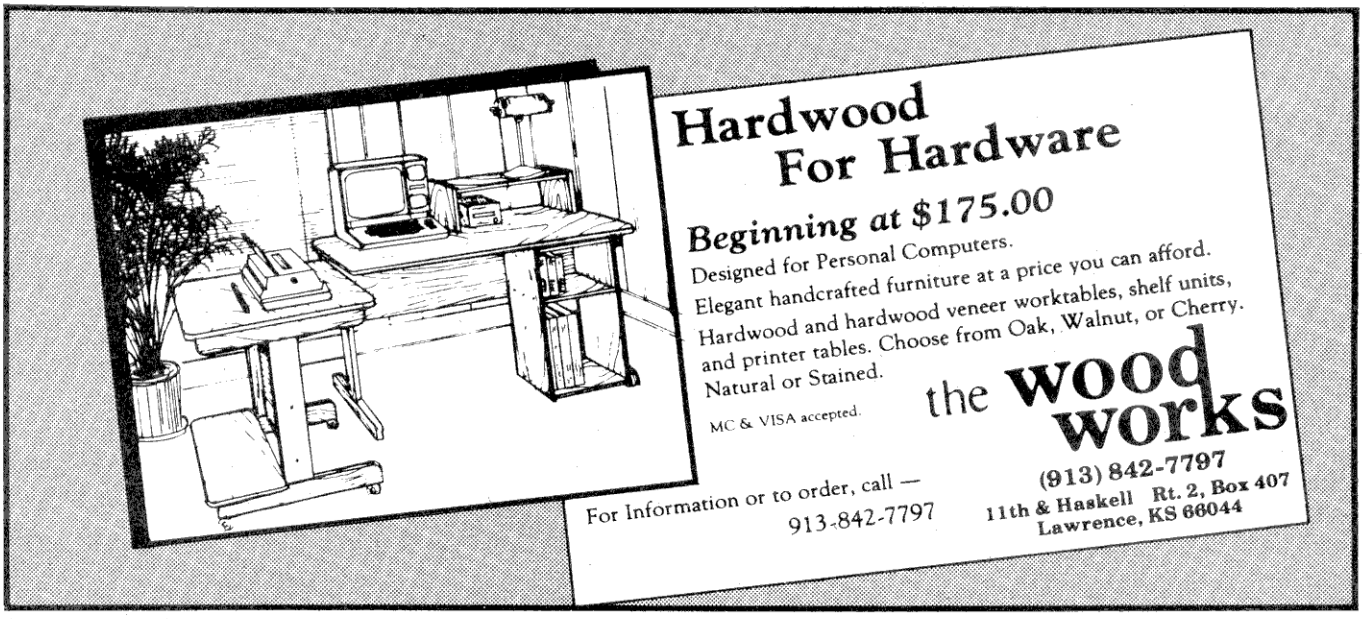
Roger Terry
Box A-461
Camarillo, CA 93011

LISP Fix

The APPEND function in my "LISP: Basically Speaking" article (March 1983, p. 176) operates differently than standard LISP when dealing with NIL. Changing the following two lines in the program listing will clear this up:

```
4310 IF ST(A)=0 THEN
X=N:A=A-ST(A)-1:
RETURN ELSE X=AS:Z=X: FOR
J=A-ST(A) TO A-1:Y=ST(J):IF Y=0 OR
Y>2000 AND Y<>N THEN
ER=4:ST(A)=Y:GOTO 25000
4313 NEXT:IF Z=X THEN
X=N:A=A-ST(A)-1:RETURN
```

Randy Beer
911 Lexington-Ontario Road
Mansfield, OH 44903



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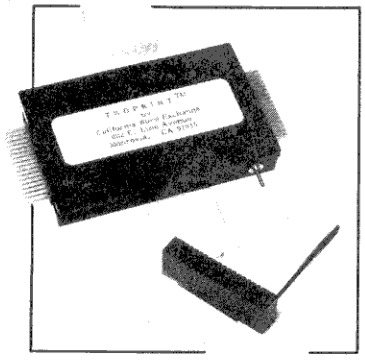

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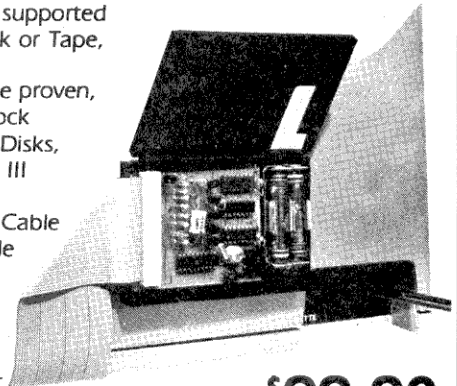

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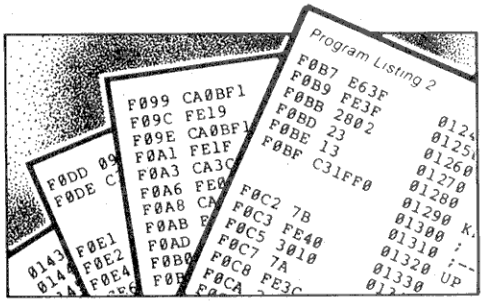

Enhancing the Flip Routine

A reader asked the question succinctly: "How can I make your Flip routine (The Next Step, *80 Micro*, March 1983, p. 37) flip the top half of the screen one time, the bottom of the screen another time, and the entire screen when I use it a third time?"

The most obvious answers are not necessarily the best: you could rewrite the screen-flip routine for each application, alter the program by POKEing new screen addresses into it, or send a parameter array to the routine, using the techniques I explained in May 1983. However, there is an easier, more powerful technique.

Your computer treats Basic programs as data manipulated by the Basic interpreter. The interpreter itself is a program that contains and creates tables of data. You must decide which sections of memory contain data and which contain program instructions. When a program bug makes the Z80 process a data structure as a set of machine-language instructions, the result is probably either a reset or a system lock-up.

One of Basic's data structures is the single-dimensioned integer array. Basic stores each value of the array in two consecutive bytes of memory. An array of nine values, for example A%(0) to A%(8), is stored in 18 consecutive bytes. The Basic interpreter must know where to store the bytes and how to retrieve them.

Basic operates on the array as a data structure, but those same 18 bytes could be used to store a short machine-language routine. The advantage of using an integer array to store a machine-language program is that Basic changes any pair of bytes in the program by merely redefining one of the array's elements. If you write the machine-language program carefully, Basic can easily access each parameter.

A Selective Screen Scroll

This month's demonstration routine lets you scroll any portion of the screen, leaving the rest undisturbed. Use it on the Model I to protect any part of the screen from scrolling, and on the Model III when the built-in scroll protection is inadequate.

The routine's source code is given in Program Listing 1. Except for the nine lines containing NOPs (No OPeration), the program is not unusual. A top line number for the scroll area is loaded into the B register; a bottom line number for the scroll area is loaded into the A register. The program then calculates the number of lines to scroll, the starting address of the scroll area, and the address of the second line of the scroll area. In line 440, an LDIR block move performs the actual scroll. Line 460 updates the cursor position and line 480 clears the last line of the scroll area by printing a line clear character: 1EH.

Pad with NOPs

You rarely find nine NOP instructions in such a short routine. The top four demonstrate the crux of the integer-array technique.

Every integer in an array holds exactly 2 bytes. Two parameters in this routine, the top and bottom lines of the vertical scroll area, must be easy to change. They are easiest to modify if each is held alone in a single integer in the array. The NOPs align the machine-language code with the array's integers. (See the comments in Program Listing 2.)

Follow these two rules when padding a machine-language routine with

```
                00100 ;****************************************
                00110 ;*                                      *
                00120 ;*   Selective Screen Scroll            *
                00130 ;*      -- Demonstration for            *
                00140 ;*      use of integer arrays           *
                00150 ;*      to hold machine-language        *
                00160 ;*      programs.                       *
                00170 ;*                                      *
                00180 ;****************************************
                00190 ;
7F00            00200           ORG     7F00H           ;ROUTINE IS RELOCATABLE
7F00 00         00210           NOP                     ;PADDING
7F01 0601       00220           LD      B,TOP           ;B=TOP LINE
7F03 00         00230           NOP                     ;AND MORE
7F04 00         00240           NOP                     ;   PADDING
7F05 3E0E       00250           LD      A,BOTTOM        ;A=BOTTOM LINE
7F07 00         00260           NOP                     ;FINAL PADDING
7F08 210000     00270           LD      HL,0000H        ;CLEAR HL
7F0B 114000     00280           LD      DE,40H          ;LINE OFFSET
7F0E 90         00290           SUB     B               ;A= BOTTOM-TOP
7F0F C5         00300           PUSH    BC              ;SAVE TOP LINE #
7F10 47         00310           LD      B,A             ;B= BOTTOM-TOP
7F11 19         00320 SCRL10    ADD     HL,DE           ;HL=HL+1 LINE OF BYTES
7F12 10FD       00330           DJNZ    SCRL10          ;HL=# OF BYTES TO SCROLL
7F14 C1         00340           POP     BC              ;RECOVER TOP LINE #
7F15 E5         00350           PUSH    HL              ;SAVE BYTE COUNT
7F16 21C03B     00360           LD      HL,3C00H-40H    ;HL==>SCREEN TOP - 1 LINE
7F19 04         00370           INC     B               ;SO B ISN'T 0
7F1A 19         00380 SCRL20    ADD     HL,DE           ;HL POINTS TO NEXT LINE
7F1B 10FD       00390           DJNZ    SCRL20          ;HL=SCROLL START ADDRESS
7F1D E5         00400           PUSH    HL              ;SAVE IT ON STACK
7F1E 19         00410           ADD     HL,DE           ;HL==>2ND SCROLL LINE
7F1F D1         00420           POP     DE              ;DE==>TOP SCROLL LINE
7F20 C1         00430           POP     BC              ;GET BYTE COUNT
7F21 EDB0       00440           LDIR                    ;MOVE IT ALL UP A LINE
7F23 EB         00450           EX      DE,HL           ;HL==>LAST LINE
7F24 222040     00460           LD      (4020H),HL      ;SAVE AS CURSOR POSITION
7F27 3E1E       00470           LD      A,1EH           ;CLEAR LINE CHARACTER
7F29 CD3300     00480           CALL    0033H           ;PRINT CHARACTER
7F2C C9         00490           RET                     ;RETURN TO BASIC
7F2D 00         00500           NOP
7F2E 00         00510           NOP
7F2F 00         00520           NOP
7F30 00         00530           NOP
7F31 00         00540           NOP
0001            00541 TOP       EQU     1               ;TEMPORARY VALUES
000E            00542 BOTTOM    EQU     14              ;FOR ASSEMBLY
0000            00550           END
00000 TOTAL ERRORS
```

Program Listing 1

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NOPs:

- To change a 2-byte value (such as a screen or memory address), be sure both bytes are in the same integer.
- To change a 1-byte value (such as a screen line number), be sure that byte is the first byte in an integer and that an NOP follows it.

The purpose of the first four NOPs in Listing 1 should now be clear. The first instruction of the program is LD B,TOP. If the selected TOP value is 2, the machine code is 06 02. To be easily altered, the TOP value must be in an integer of its own, so an NOP is added before and after the instruction to produce the machine code 00 06 02 00. Likewise, the NOPs in lines 240 and 260 isolate the second parameter.

The five NOPs at the end of the program serve a different purpose—marking the end of the program with at least two zero-integer values, and making the conversion from machine code to Basic variables easier. They help you recognize the end of the routine.

```
10 '*******************************************
11 '*                                         *
12 '*             CONVERT/BAS                 *
13 '*                                         *
14 '*    This program converts a machine-     *
15 '*    language program in memory to        *
16 '*    integer values to be used in         *
17 '*    integer arrays.                      *
18 '*                                         *
19 '*******************************************
20 '
30 '
40 M% = 32512 : 'This equals 7F00H -- change it to equal
50              'the ORG of your assembled program
60 L% = 49    : 'L% equals the length of your assembled
70              'program
80 '
90 '
100 FOR I% = M% TO M% + L% STEP 2
110    K = PEEK(I%) + PEEK(I%+1)*256
120    IF K > 32767 THEN K = K-65536
130    LPRINT K;", ";
140 NEXT I%
```

Program Listing 2

```
1 '*******************************************
2 '*                                         *
3 '*  Selective Screen Scroll Routine        *
4 '*     Place in an integer array.          *
5 '*                                         *
6 '*     Uses RESTORE Patch described        *
7 '*     presented last month                *
8 '*                                         *
9 '*******************************************
10 '
11 '
50000 '****     SCRL -- scrolls any portion of the screen
50001 '         QA%(1) = Top line of scroll (0 - 14)
50002 '         QA%(3) = Bottom line of scroll (1 - 15)
50003 '**     Initialize -- GOSUB 50005
50004 '       Call       -- GOSUB 50007
50005 Q%=0 : DIM QA%(22) : RESTORE 50006 :
          FOR I%=0 TO 22 : READ QA%(I%) : NEXT :
          RETURN
50006 DATA 1536, 1, 15872, 14, 33, 4352, 64, -14960, 6471,
          -752, -6719, -16351, 1083, 4121, -6659, -12007,
          -4671, -5200, 8226, 15936, -13026, 51, 201
50007 DEFUSR = VARPTR(QA%(0)) : Q%=USR(0) : RETURN
50008 '*** NOTE -- for tape systems, line 50007 should be
          Q%=VARPTR(QA%(0)) : POKE 16526,Q%-INT(Q%/256)*256 :
          POKE 16527,INT(Q%/256) : Q%=USR(0) : RETURN
```

Program Listing 3

Converting to Basic

Listing 2 converts the assembled object code to integer values. Be sure to set the values of J and K correctly. If you don't have a printer, change the LPRINT in line 270 to PRINT.

This converter program is simple to use. Load the assembled code into memory. With a disk system, use the Load command from DOS. With tape, use the System command to load the program, but press break at the second "?" prompt. Then load and run the converter program. If you don't use a printer, write down the values that appear on the screen.

Ignore the final zero values, which mark the routine's end. The rest of the converter's output is the list of integers that you store in an array in your program.

Building the Basic Routine

Once you have the values from Listing 2, you're home free. The last step is to set up two short Basic subroutines to process the program. If you are using the Restore modification I discussed last month, use Program Listing 3; otherwise use Program Listing 4.

The easiest way to use machine-language programs stored in integer arrays is to create two subroutines—one to initialize the program and the second to run it. I use high line numbers, include documentation comments, and store them together in a single disk file. When I want to use a subroutine, I merge the file into my program, delete those arrays I don't want, and delete the comments after the program is written and debugged. I also reserve variable names beginning with Q solely for these routines so I don't create conflicts with other variable names in my programs.

Line 50005 begins the initialization subroutine. The first statement, Q% = 0, needs some explanation. Basic stores arrays in a data table just above the one it uses for simple variables. Each time a simple variable is created, all array variables are moved up in memory. If Q% were not previously defined, the statement in line 50007, Q% = USR(0), would move the integer array to make room for Q%, and the USR routine would jump to a wrong, and probably fatal, address.

After defining Q%, the subroutine at 50005 defines each of the integers in the array and then returns. By comparing

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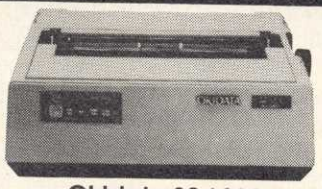

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```
1 '*****************************************
2 '*                                       *
3 '*  Selective Screen Scroll Routine      *
4 '*     Place in an integer array.        *
5 '*                                       *
6 '*      Does not use the RESTORE Patch   *
7 '*                                       *
8 '*****************************************
9 '
10 '
50000 '****     SCRL -- scrolls any portion of the screen
50001 '         QA%(1) = Top line of scroll (0 - 14)
50002 '         QA%(3) = Bottom line of scroll (1 - 15)
50003 '**     Initialize -- GOSUB 50005
50004 '       Call       -- GOSUB 50007
50005 Q%=0 : DIM QA%(22) : QA%(0)=1536 : QA%(1)=1 :
       QA%(2)=15872 : QA%(3)=14 : QA%(4)=33 : QA%(5)=4352 :
       QA%(6)=64 : QA%(7)=-14960 : QA%(8)=6471 : QA%(9)=-752:
       QA%(10)=-6719 : QA%(11)=-16351 : QA%(12)=1083
50006  QA%(13)=4121 : QA%(14)=-6659 : QA%(15)=-12007 :
       QA%(16)=-4671 : QA%(17)=-5200 : QA%(18)=8226 :
       QA%(19)=15936 : QA%(20)=-13026 : QA%(21)=51 :
       QA%(22)=201 : RETURN
50007 DEFUSR = VARPTR(QA%(0)) : Q%=USR(0) : RETURN
50008 '*** NOTE -- for tape systems, line 50007 should be
          Q%=VARPTR(QA%(0)) : POKE 16526,Q%-INT(Q%/256)*256 :
          POKE 16527,INT(Q%/256) : Q%=USR(0) : RETURN
```

Program Listing 4

```
1 '*************************************
2 '*                                   *
3 '*   Demonstration routine for       *
4 '*     SCRL - screen scroller        *
5 '*                                   *
6 '*************************************
10 A$="SCROLL DEMONSTRATION LINE"
20 GOSUB 50005
30 FOR J=7 TO 0 STEP -1
40      QA%(1)=J : QA%(3)=15-J
50      GOSUB 120
60      FOR K = 1 TO 16-2*J
70          GOSUB 50007
72          FOR L=1 TO 10 : NEXT L
80      NEXT K
90      IF INKEY$="" THEN 90
100 NEXT J
110 END
120 CLS :FOR K=0 TO 15
130     PRINT @ K*66, A$ ; K ;
140 NEXT K
150 RETURN
160 '
170 '********  ADD either Program Listing 3
                    or Program Listing 4
                        here
```

Program Listing 5

Listing 3 with Listing 4, you can see the utility of last month's Restore modification. In fact, I originally wrote it for use with integer array subroutines.

The second program you need to write runs the USR routine. The beginning of the machine-language program (which is also the beginning of the array) starts with the VARPTR function and initializes the USR. Initialize the USR address each time you call the routine to be sure that Basic has not relocated the array to a new address while your program was elsewhere.

The strength of this technique is the ease with which you can change the machine-language program. Before every GOSUB 50007 in your main program, you can modify the values in QA%(1) and QA%(3), changing the top and bottom of the scrolled area of the screen. Don't let your program load integers with erroneous values—the machine-language routine doesn't include any error checks. A scroll between lines 3 and 35, for example, is disastrous.

Program Listing 5 is a short demonstration routine you can add to the beginning of either Listing 3 or 4. If you use it, you should understand how to set up and call the integer-array subroutines. You'll see how to change the scroll routine each time it is called and its effect on the screen display.

Back to the Question

Having explained so much, I still haven't answered the original question. Program Listings 6, 7, and 8 are source codes from demonstration routines I've explained over the past several months. However, each has been padded with NOPs to work with the integer-array technique. Program Listing 9 shows the Basic subroutines needed to access those demonstrations, complete with documentation comments. Use Listing 9 to start your own library of machine-language subroutines. If you want more, take a look at Lewis Rosenfelder's book, *Basic Faster and Better & Other Mysteries* (IJG Inc., Upland, CA, 1981).

"The strength of this technique is the ease with which you can change the machine-language program."

One word of warning. If you include more than three or four integer-array routines in a Basic program, execution speed might drop as Basic shuffles around the arrays each time you define a new simple variable. Since the purpose of machine-language routines is to speed up your Basic program, you have to make a choice: live with the slower speed (never!), reduce the number of integer arrays used (but that leads to duller programs), or, best of all, define all simple variables at the beginning of your program, preferably with a DIM statement.

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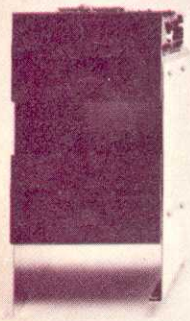

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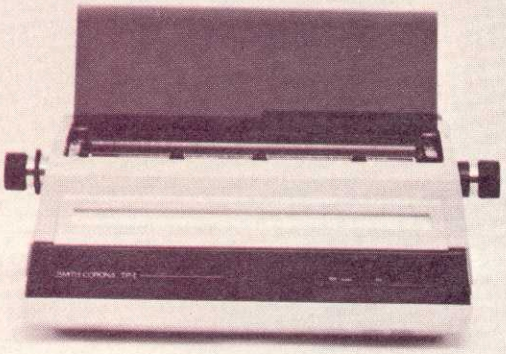

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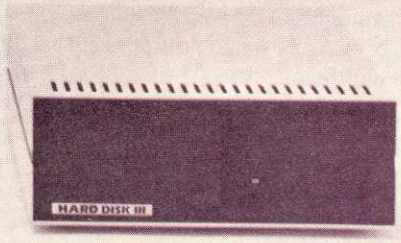

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mand. It creates space for variables A, B, and C in Basic's simple variable table and helps speed up almost any Basic program that uses arrays. One further hint—define the variables in order of use. Put those used most often first, and those used least often at the end. Basic searches from the beginning of the variable table each time a variable is used in a program. If the most frequently used variables are at the beginning of the table, the Basic interpreter doesn't have to look as far, and program execution is faster. For short programs, the change is unnoticeable; long, complex programs, on the other hand, exhibit a significant increase in speed when variables are predefined.

In the coming months, I will look at ways to use the "mysterious" low memory (the bytes that Basic won't let you use) to enhance your programs. ■

Write to Hardin Brothers at 280 N. Campus Ave., Upland, CA 91786, or contact him through CompuServe. His e-mail address is 72165,735.

```
                00100 ;************************************
                00110 ;*  Screen-fill routine to be used  *
                00120 ;*  with an integer array in Basic  *
                00130 ;************************************
                00140 ;
7F00            00150          ORG     7F00H           ;PROGRAM IS RELOCATABLE
7F00 00         00160          NOP                     ;FOR PADDING
7F01 21003C     00170          LD      HL,3C00H        ;HL==> TOP OF SCREEN
7F04 00         00180          NOP                     ;PAD AGAIN
7F05 010004     00190          LD      BC,400H         ;BC=# OF BYTES TO FILL
7F08 00         00200          NOP                     ;PAD AGAIN
7F09 36BF       00210 LOOP     LD      (HL),0BFH       ;0BFH= 191
7F0B 00         00220          NOP                     ;LAST PAD
7F0C 23         00230          INC     HL              ;POINT TO NEXT BYTE
7F0D 0B         00240          DEC     BC              ;DROP BYTE COUNT
7F0E 78         00250          LD      A,B             ;GET MSB AND
7F0F B1         00260          OR      C               ;  MERGE WITH LSB
7F10 20F7       00270          JR      NZ,LOOP         ;GO UNTIL DONE
7F12 C9         00280          RET                     ;BACK TO BASIC
7F13 00         00290          NOP
7F14 00         00300          NOP
7F15 00         00310          NOP
7F16 00         00320          NOP
7F17 00         00330          NOP
0000            00340          END
00000 TOTAL ERRORS
```

Program Listing 6

```
                00100 ;************************************
                00110 ;*  Flip routine to be used with    *
                00120 ;*  an integer array in Basic       *
                00130 ;************************************
                00140 ;
7F00            00150          ORG     7F00H           ;PROGRAM IS RELOCATABLE
7F00 00         00160          NOP                     ;ADD PADDING
7F01 21003C     00170          LD      HL,3C00H        ;HL==>TOP OF SCREEN
7F04 00         00180          NOP                     ;AND MORE PADDING
7F05 010004     00190          LD      BC,400H         ;BC=# OF BYTES TO FLIP
7F08 7E         00200 LOOP     LD      A,(HL)          ;GET BYTE FROM SCREEN
7F09 17         00210          RLA                     ;BIT 7 TO CARRY FLAG
7F0A 3008       00220          JR      NC,GO           ;GO IF NOT GRAPHICS
7F0C 17         00230          RLA                     ;BIT 6 TO CARRY FLAG
7F0D 3805       00240          JR      C,GO            ;GO IF MODIII SP. CHAR.
7F0F 2F         00250          CPL                     ;COMPLEMENT BITS 0 - 5
7F10 1F         00260          RRA                     ;RESTORE BIT 6
7F11 37         00270          SCF                     ;SET CARRY FLAG TO
7F12 1F         00280          RRA                     ;  RESTORE BIT 7
7F13 77         00290          LD      (HL),A          ;PUT IT ON SCREEN
7F14 23         00300 GO       INC     HL              ;POINT TO NEXT BYTE
7F15 0B         00310          DEC     BC              ;DROP BYTE COUNTER
7F16 78         00320          LD      A,B             ;GET MSB OF COUNTER
7F17 B1         00330          OR      C               ;  AND MERGE WITH LSB
7F18 20EE       00340          JR      NZ,LOOP         ;GO UNTIL DONE
7F1A C9         00350          RET                     ;BACK TO BASIC
7F1B 00         00360          NOP
7F1C 00         00370          NOP
7F1D 00         00380          NOP
7F1E 00         00390          NOP
7F1F 00         00400          NOP                     ;END MARKERS
0000            00410          END
00000 TOTAL ERRORS
```

Program Listing 7

Program Listing 8

```
                00100 ;************************************
                00110 ;*  Melt routine to be used with    *
                00120 ;*  integer array in Basic          *
                00130 ;************************************
                00140 ;
7F00            00150          ORG     7F00H           ;PROGRAM IS RELOCATABLE
7F00 00         00160          NOP                     ;PADDING
7F01 11A000     00170          LD      DE,0A0H         ;# OF PASSES TO MAKE
7F04 00         00180          NOP                     ;PADDING
7F05 21003C     00190 LOOP1    LD      HL,3C00H        ;HL==>TOP OF SCREEN
7F08 00         00200          NOP                     ;PAD AGAIN
7F09 010004     00210          LD      BC,400H         ;BC=# OF BYTES TO MELT
7F0C 7E         00220 LOOP2    LD      A,(HL)          ;GET SCREEN BYTE
7F0D FE21       00230          CP      21H             ;LOWEST VALUE + 1
7F0F 00         00240          NOP                     ;FINAL PADDING
7F10 3801       00250          JR      C,GO            ;GO IF DONE
7F12 35         00260          DEC     (HL)            ;ELSE DEC. CHARACTER
7F13 23         00270 GO       INC     HL              ;BUMP POINTER
7F14 0B         00280          DEC     BC              ;DROP BYTE COUNT
7F15 78         00290          LD      A,B             ;GET MSB OF COUNT AND
7F16 B1         00300          OR      C               ;  MERGE WITH LSB
7F17 20F3       00310          JR      NZ,LOOP2        ;GO UNTIL DONE
7F19 1D         00320          DEC     E               ;DROP PASS COUNTER
7F1A 20E9       00330          JR      NZ,LOOP1        ;DO WHOLE SCREEN AGAIN
7F1C C9         00340          RET                     ;BACK TO BASIC
7F1D 00         00350          NOP
```

Listing 8 continues

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Listing 8 continued

```
7F1E 00       00360         NOP
7F1F 00       00370         NOP
7F20 00       00380         NOP
7F21 00       00390         NOP                    ;LAST END MARKER
0000          00400         END
00000 TOTAL ERRORS
```

```
1 '*****************************************
2 '*                                       *
3 '*        FILL, FLIP, AND MELT           *
4 '*   written as integer-array routines   *
5 '*                                       *
6 '*****************************************
7 '
8 ' NOTE: These routines are written in Disk Basic
9 '    and use the modified RESTORE command presented
10 '    in this column last month.
11 '
12 ' To change for tape systems, lines
13 '   must be modified as follows:
14 '
15 'Q%=VARPTR(Qx%(0)):POKE 16526,Q%-INT(Q%/256)*256:
              POKE 16527,INT(Q%/256): Q%=USR(0):RETURN
16 'where Qx%(0) is QB%(0), QC%(0), or QD%(0)
17 '
18 ' To use without the modified RESTORE, each array element
19 '    must be separately loaded with its appropriate value
20 '    (see Program Listing 4)
21 '
22 '
50010 '****  FILL -- fills any portion of screen (or other
                  memory) with any selected character
50011 '         QB%(1) = Top of area to fill (15360 = top
                                          of screen)
50012 '         QB%(3) = Number of bytes to fill (1024 =
                                          full screen)
50013 '         QB%(5) = ASCII value of fill character
50014 '**   Initialize -- GOSUB 50016
50015 '     Call       -- GOSUB 50018
50016 Q%=0 : DIM QB%(9) : RESTORE 50017 :
       FOR I%=0 TO 9 : READ QB%(I%) : NEXT : RETURN
50017 DATA 8448, 15360, 256, 1024, 13824, 191, 2851, -20104,
          -2272, 201
50018 DEFUSR=VARPTR(QB%(0)) : Q%=USR(0) : RETURN
50019 '
50020 '****  FLIP -- complements all graphics on the screen
50021 '         QC%(1) = Beginning of area to flip (15360 =
                                          top of screen)
50022 '         QC%(3) = Number of bytes to flip (1024 =
                                          full screen)
50024 '**  Initialize -- GOSUB 50026
50025 '    Call       -- GOSUB 50028
50026 Q%=0 : DIM QC%(13) : RESTORE 50027 :
            FOR I%= 0 TO 13 : READ QC%(I%) : NEXT :
            RETURN
50027 DATA 8448, 15360, 256, 1024, 6014, 2096, 14359, 12037,
          14111, 30495, 2851, -20104, -4567, 201
50028 DEFUSR = VARPTR(QC%(0)) : Q%=USR(0) : RETURN
50029 '
50030 '****  MELT -- "melts" any portion of the screen, any
                  number of times with any given lowest
                  character
50031 '         QD%(1) = number of passes through screen
                                          (1 to 255)
50032 '         QD%(3) = Top of area to melt (15360 = top
                                          of screen)
50033 '         QD%(5) = Length of melt area (1024 = whole
                                          screen)
50034 '         QD%(7) = Lowest chaacter to melt to + 1  !!
                                          (33 = ASCII space)
50035 '**   Initialize -- GOSUB 50036
           Call       -- GOSUB 50038
50036 Q%=0 : DIM QD%(14) : RESTORE 50037 :
            FOR I%= 0 TO 14 : READ QD%(I%) : NEXT :
            RETURN
50037 DATA 4352, 160, 8448, 15360, 256, 1024, -386, 33, 312,
          9013, 30731, 8369, 7667, -5856, 201
50038 DEFUSR = VARPTR(QD%(0)) : Q%=USR(0) : RETURN
50039 '
```

Program Listing 9

Instant Assembler

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The Instant Assembler is a powerful assembly language development system for the TRS-80, and our new version is better than ever. If you are already an assembly language programmer, its unique design will greatly increase your productivity. If you're just getting started, there is no better assembler to help you learn machine language programming. Our new version includes the following features:

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The **Instant Assembler** package includes six separate programs. The assembler itself includes the editor and built-in debugger. The **Linking Loader** is included in several versions for different memory sizes. A stand-alone version of the debugger (**MicroMind**) is also included. **MicroMind** can be relocated in memory and has commands to single-step, set breakpoints, display or alter registers or memory, find bytes or words, disassemble to screen or printer, convert between hex and decimal numbers, and write SYSTEM tapes.

INTASM 2.1 is $39.95 for the tape version and $49.95 for disk (specify Model I or Model III). The instruction manual only is $5, refundable with purchase of the program. Include $2 postage, and California residents add 6% sales tax. VISA, MASTERCARD, and COD orders are accepted. Satisfaction is guaranteed or a full refund will be made. ✓ 55

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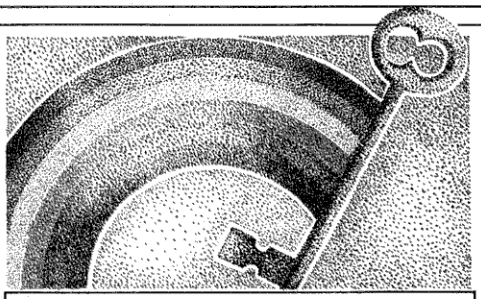
THE COLOR KEY

by Scott Norman



Speculations about a new software tool

I'd like to comment on some of the add-on languages available for the Color Computer. Sorry I can't overwhelm you with an all-purpose program written in one of them, but I do have a few opinions. Just remember that these are subjective and subject to change.

Pilots used to talk about "type hogs"—people who made it a point to fly as many types of aircraft as possible, however briefly. I'm a bit of a high-level language hog. I find new languages awfully interesting, although time seldom permits me to become deeply immersed in them.

I've stayed aware of what is available for the CoCo, though. I've already reviewed several languages, Pascal (*80 Micro*, September 1982, p. 198), Forth (*80 Micro*, December 1982, p. 80), and Random Basic (*80 Micro*, April 1983, p. 198). I have also done a little digging into C and the Shack's Color Logo, and expect to spend more time with languages requiring FLEX or OS-9.

Up to this point, Pascal has been more trouble than it's worth. I know it's the prototype of modern structured languages, but the limitations of the Dynasoft implementation (sold by Computerware and Frank Hogg Labs) are too severe to be easily overcome. The lack of floating-point variables is troublesome, as is the effort required to handle string input/output and to define screen formats.

Still, I remain optimistic. My experience is restricted to the old 16K package. The situation will improve greatly if there's ever a CoCo version of Microware's OS-9 implementation, or something else that capitalizes on 64K.

Forth continues to intrigue me. It allows me to think I'm getting close to controlling the computer without having to go all the way to Assembly language. Perhaps paying close attention to the entry positions on the stack and other details soothes my conscience. But I seldom program in Assembly language because I'm not intrigued by microprocessor architecture.

I think Forth has real advantages for control applications, an opinion buttressed by the history of the language's development. It is also sufficiently compact so that a 32K computer runs utilitarian Forth programs; even 16K can be useful. The high degree of standardization that the Forth User's Group encourages hasn't hurt, either.

The Forth package I use comes from Armadillo International Software. There are several other vendors, though, and some of them offer implementations designed to capitalize on CoCo graphics and other features. You might want to check them out.

I liked Computerware's Random Basic from the start, and it remains a favorite of mine. That 200-decade range for floating-point variables is invaluable for a variety of scientific and engineering problems, and the facilities for error-trapping and user-defined functions make it a near-professional language.

Random Basic requires 64K and FLEX, and it doesn't support high-resolution graphics. The former isn't too much of a limitation, as it represents the only practical way to get another Basic interpreter into a Color Computer. You couldn't do it in 32K RAM. The lack of graphics capability is more serious, and I plan to work on an interim solution for certain problems.

Suppose I have a Random Basic program whose output produces a two-dimensional array. My idea is to write it to a sequential disk file, exit Random Basic, and invoke DBasic.

It should be possible to write a DBasic program to read the file and produce a high-resolution graph of the results. Anyway, that's the plan. I'll keep you informed, and maybe I'll have something in time for the science issue in the fall.

Useful Tools

I have a weakness for software tools; anything that promises to ease the mechanics of either programming or controlling the computer's operating characteristics gets my attention. One of my first loves is Soft Sector Marketing's Master Control keyboard redefinition package for the Basic programmer (reviewed in *80 Micro*, March 1982, p. 49).

More recently, I've been getting a lot of mileage out of another set of tools with a somewhat different orientation. The product is a relocatable machine-language program called Colorkit, the brainchild of George Ziniewicz at Arizin Inc. (P.O. Box 8825, Scottsdale, AZ 85252).

A versatile package, Colorkit provides 33 commands that increase the user's control over the machine at run time, expand the Color Basic editor, provide convenient access to memory, and define up to ten function keys.

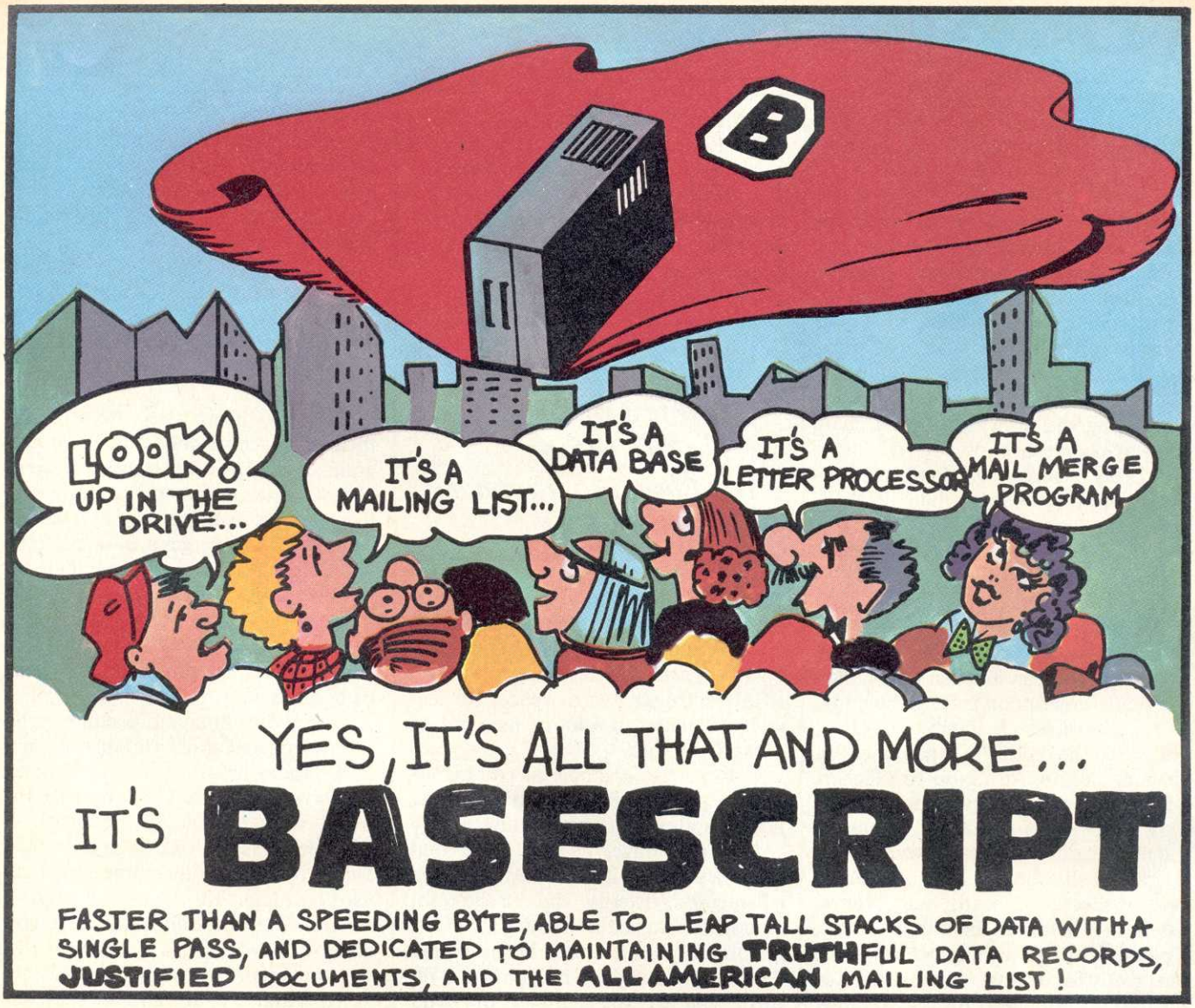
Colorkit is available on tape and disk, and requires a little under 5300 bytes of RAM. If you can spare the room, load it into high memory at the beginning of a session and leave it there.

It's compatible with the Basic ROMs so you can EXEC the kit and go about your programming business, invoking Colorkit commands as you need them. You can also load and run other programs, as long as no memory conflict exists.

For those of you strapped for memory, Arizin makes a junior version of Colorkit called Microkit that requires only half the memory. In my opinion, though, the ten commands it omits include some of Colorkit's most useful.

First of all, Colorkit includes a full-screen editor that lends a different flavor to Basic programming. Personally, I find Extended Color Basic's line-oriented edit command a bit of a pain. Full-screen editing is much more convenient for the amount of word processing I do.

You invoke the editor with .SCON (Colorkit commands are typically three or four uppercase characters preceded by a period). The arrow keys control four-way cursor movement, and you can replace characters by overtyping.



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You can open spaces with the shift/right arrow combination, and close them with shift/left arrow.

One oddity: The Colorkit cursor has autorepeat motion, but nonuniform speed. It visibly accelerates to its maximum speed if you hold down an arrow key. Precise control is an acquired skill.

No scrolling is provided, so if you want to edit a long program you must stop the listing after every screen page. Colorkit's .PDLY command helps by controlling the print delay on a character-by-character basis.

A delay of zero results in the conventional printing speed, while .PDLY9 gives you time for a quick snack between lines. A single-step mode continues printing as long as a key is depressed.

An analogous command, .RDLY, controls the running speed of a Basic program. You can imagine how handy the single-step option is for debugging.

The global search command, .GBL, enhances the editor's capabilities. It finds a specified string up to 11 characters long in a Basic program.

If the string is a reserved command name, though, you must precede it with a backslash character (shift/clear). Spaces specify wildcard search characters. If it finds the target string, Colorkit displays the appropriate Basic line, ready for editing. You can look for the next occurrence of the search target by entering a single period.

The .FN command gives the CoCo's numeric keys user-defined functions. You can save yourself a lot of work when entering a program by using .FN to set up frequently used sequences up to 250 keystrokes long.

You program a key by hitting the @, the =, and the number of the key itself. Colorkit responds with "PROGRAM," and you enter the desired keystrokes. These can include blanks that are filled in later with numerical values, using the full-screen editor.

For example, a graphics program might frequently use a sequence like:

```
DRAW "BM--,--,
```

Where screen coordinates replace the hyphens whenever you use the command.

You can store function key definitions in a buffer below Colorkit itself, save them, and retrieve them when you subsequently load the program.

To use a function key, press @ followed by the key number. To some extent, this feature overlaps the functions of Master Control and Eigen Systems' Basic Aid, although Colorkit doesn't replace either of them.

"Colorkit has a few options to offer the Basic programmer at run time."

Every Basic programmer is aware of the conflict between good programming practice and efficiency of operation; if your program is well documented with REMs and uses lots of spaces for legibility, it takes up a lot of memory. It runs slower, too.

Colorkit has a couple of commands that help: .DELR and .DELS delete REM statements and unnecessary spaces respectively. You write and debug a program in expanded form, get a listing for posterity, and use the commands to compact everything.

.DELR gives a screen listing of the deleted lines, and both commands inform you of the number of bytes deleted.

Colorkit has a few options to offer the Basic programmer at run time. You can merge programs with it, for example. Disk users have always had the Merge command, and cassette users can use the well-known PEEK/POKE sequences, but these have limitations.

Merge requires ASCII files, and both techniques require the second program to have the higher line numbers before you start. Colorkit's technique might be easier.

Load the program that is to be first in the final product. Make a note of its highest line number, and enter Colorkit's .PROT command. This effectively hides the program from sight and protects it from being overwritten by subsequent loading operations.

Load the second program, and use Basic's RENUM if necessary to get its line numbers into the proper range. Finally, enter .REST to restore the first program. The two are now merged, and you can run or save them as usual.

The .PROT/.REST pair allows you to protect one program while you work on another. If desired, you could load, edit, run, save, and clear out the second program with NEW while the first one is under wraps.

NEW doesn't destroy a program in memory; it just resets certain pointers. Should you make an error and use NEW before saving a valuable program, Colorkit lets you get it back with the command .OLD.

Colorkit offers two methods for melding machine code and Basic programs. The .DATA command converts code to data statements and appends them to an existing Basic program, while .MMRG merges a Basic program with a block of memory containing the raw code. It then returns an address that a Basic USR statement can use. I haven't worked with this feature, but it should relieve the programmer of a lot of bookkeeping.

The .VAR command produces a list of numeric and string variables defined by a running program up to the point at which you invoke it. This handy feature tracks down conflicts from reusing a variable name. .VAR displays the number of bytes of string storage currently used and reserved, the top of program memory, and the available free memory.

A final pair of run-time commands, .TXON and .TXOF, give the user control over the interchange between text and graphics screens when a running program encounters certain I/O statements. Normal Color Basic operation is equivalent to the use of .TXON, which the Colorkit documentation translates as Auto Text Screen.

That is, a program reverts to the text screen when a print or input command comes up, even if it's been displaying graphics. If you invoke .TXOF however, no such switch takes place. You can then enter invisible commands from the keyboard.

An example is in order. I wrote a simple program to generate concentric circles in PMODE4 terminated by the kind of endless loop often used to keep a graphics display on the screen.

Before running the program, I entered .TXOF. When the circles were complete, I hit break. Normally, the display reverts to the text screen with a break message; this time, the graphics remained on screen. I could enter key-

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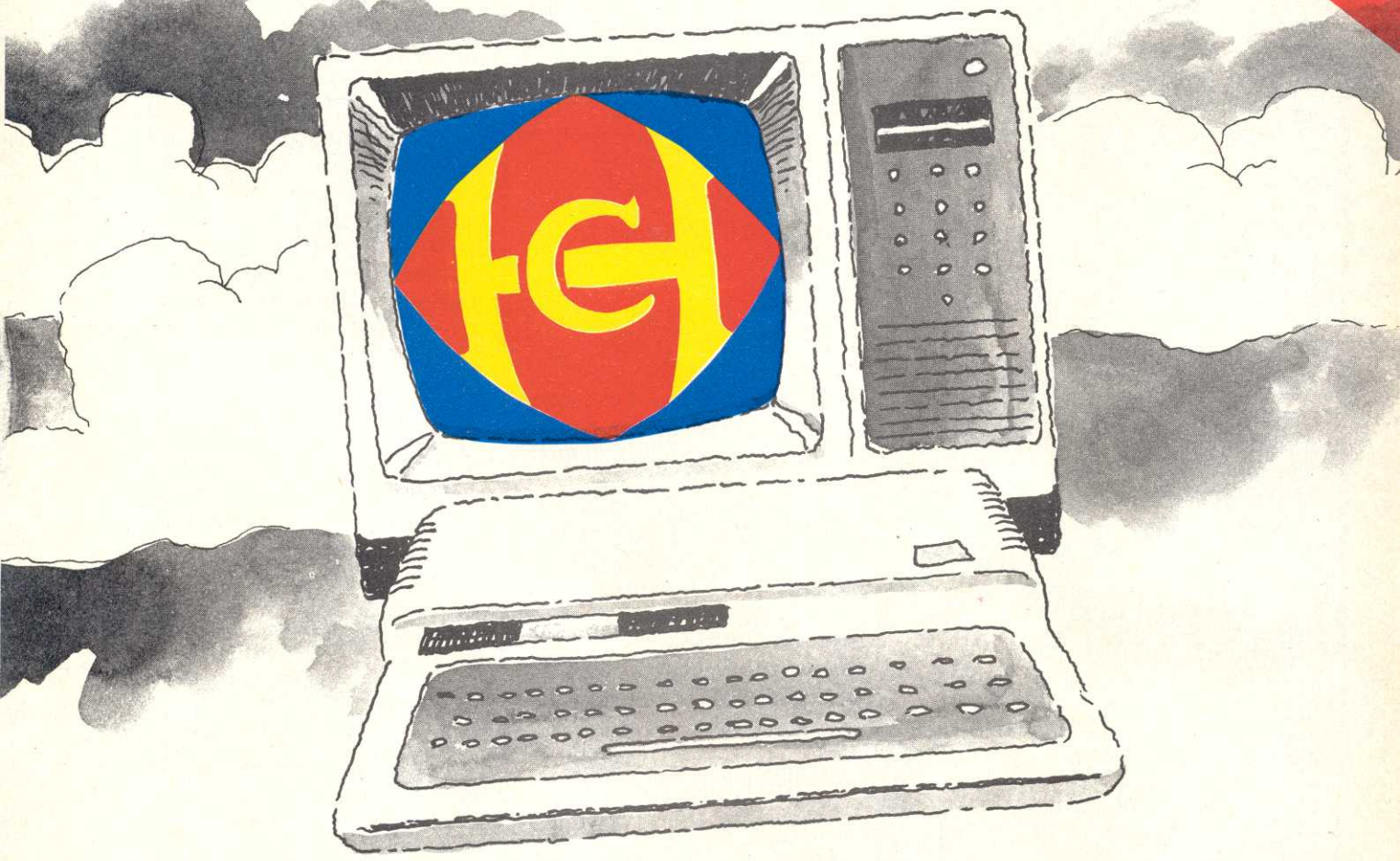

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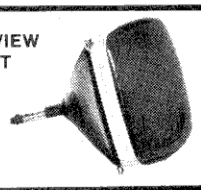

FOR THE FULL STORY SEE PAGE 43

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board commands, however. .PCLS clears the display, and Run starts the process over again, with neither command appearing on the screen.

This feature lends itself to games requiring keyboard inputs while a graphics screen is in place. I hope to apply it to such a program for a column in the near future.

"...software tools... can greatly increase your control over the computer..."

To help you keep track of command entries, Colorkit has a keyclick feature. The use of .KLON turns on an audio signal equivalent to Extended Color Basic's SOUND 234,1 at each key contact closure. You can change the pitch with an appropriate POKE. I prefer SOUND 30,1.

You can customize other aspects of Colorkit, including the speed of cursor acceleration during editing, the color and blink rate of the cursor itself, and various default delay values. Even the names of Colorkit commands are subject to alteration. You can save all such changes on tape or disk.

So much for my pet programming and run-time tools. As befits a proper toolkit, Colorkit also includes a clutch of commands for examining, changing, and moving blocks of memory.

.MEM prompts you for an address, then displays it in hex and decimal, along with its contents in hex, ASCII, decimal, and double decimal. That should satisfy anyone.

That last mode is a 16-bit value equal to 256 times the contents of the location in question, plus the contents of the next address. It's useful for evaluating pointers in Color Basic's storage format.

Once you invoke .MEM, you can romp through memory with the up and down arrows. You can enter new data into any cell without a special insert mode; stop at the address in question and type away. There is one catch, though: In general, you should enter data in hex.

If the value corresponds to the ASCII code for a keyboard character, you can enter that character as a string literal instead. You can't enter data in decimal format, even though the display will subsequently show the correct decimal values for hex entries.

.DUMP produces a printer or screen listing of a specified portion of memory, but without .MEM's data entry capability.

.BLOK moves any portion of memory to a specified section of RAM. You can set it up as a nondestructive copy operation, or as a true block move (assuming the original material is in RAM, not ROM).

A final convenience, .SAV, displays the start, end, and execution addresses of a machine-language program loaded from tape. The complete display has the form:

```
CSAVEM "filename", start, end, execute
```

If the Colorkit's cursor is positioned at the end of this line, pressing enter makes a back-up tape copy.

If you first delete the C in CSAVEM, you get a disk copy. This illustrates use of the editor to perform direct commands (those not contained in a program).

Some of Colorkit's commands and features are more valuable than others, and consequently I use them most of the time. The point is that software tools are fun. They can greatly increase your control over the computer, making it easy to perform tedious, difficult, or impossible tasks.

I expect to continue to report on any tools that strike me as especially useful. The Colorkit is available on tape for $29.95, and on disk for $34.95. The Microkit costs $2 less in each format.

Thank You

My bleating about the CoCo's keyboard in the first few Color Keys apparently struck a sympathetic chord. A number of readers responded with keyboard information.

As regular readers know by now, I've switched to the Micronix keyboard. I do want you to know that I appreciate the tips. In this case, publishing lead times meant that I had my solution before most of you knew of my problem, but next time I might not be so lucky. ■

Scott Norman welcomes reader response to The Color Key. Write c/o 80 Micro, 80 Pine St., Peterborough, NH 03458.

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Lets you use graphics	Yes	Yes
Maximum number of calculated fields	60	32
Maintains separate Key File	Yes	No
Requires a special Operating System to be used	No	Yes
Uses standard ASCII File structure for Master Files	Yes	No
Data Easily accessed by other programs	Yes	No
EASY to Follow documentation	Yes	?
Automatically writes a manual for each Filing Program it creates, if you want it to	Yes	No
Lets you start from a previously created program form	Yes	?
Lets you string search for data in key fields of any field or anywhere in a file	Yes	No
Prompted Less than, Greater than or equal to on number fields	Yes	No
SORTS any record field	Yes	Yes
FREE Indexing utility	Yes	No
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SUPPORTED & AVAILABLE on all of these machines: TRS-80 Model 4 & III TRS-80 Model II TRSDOS TRS-80 Model II CP/M TRS-80 Model I TRSDOS, NEWDOS TRS-80 Model 16 IBM 5150 IBM-PC IBM-PC XT OSBORNE Portable Apple II or IIe with CP/M COMMODORE 64 (Soon) 8" CP/M SD Disk	Yes	No
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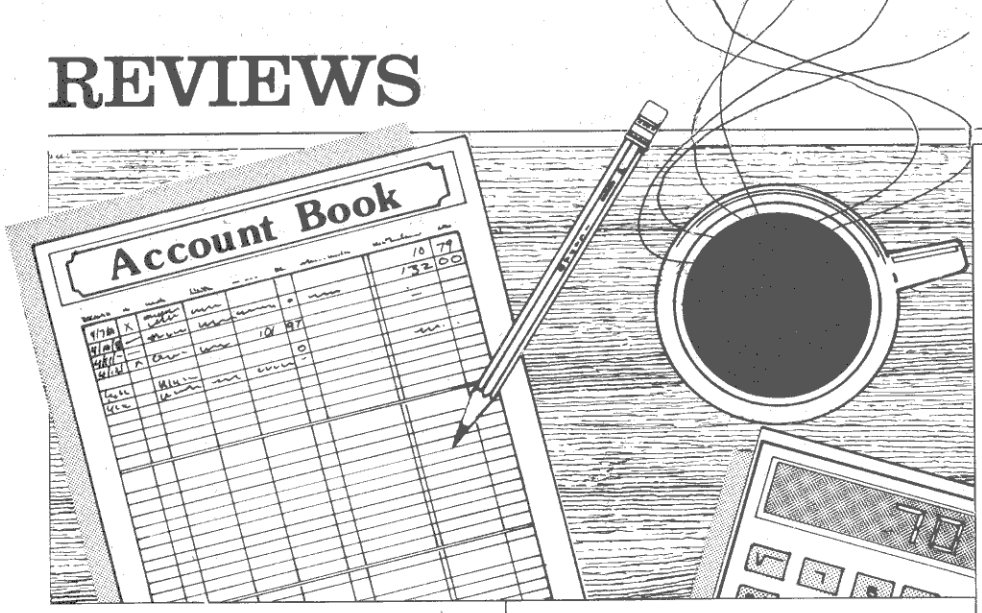

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Our reviewers use a five-star rating system. One star represents the low end of this spectrum, while five stars represent the spectacular and high end of the spectrum.

★★★★★

Tallymaster 1.2
Prosoft
Box 560
North Hollywood, CA 91603
Models I and III
$79.95

by R. Walter Steur

Chuck Tesler of Newscript fame has written Tallymaster to fill the breach between hand-written account books and VisiCalc-type programs. Tallymaster is a program for the individual and householder as well as the businessman.

Tallymaster is a disk-based, machine-language program for TRS-80 Models I and III, and the IBM PC. The disk contains the Tallymaster program, a Help file, four Example files that illustrate the program's use, and a Household file to help set up an individual record-keeping system. You can transfer these files to a formatted disk or a system disk with Tallymaster's transfer utility.

Documentation

The documentation is clear, detailed, and easily understood by any novice. The manual is in an attractive 9-by-7-inch binder and is almost 100 pages long, including a table of contents and an index.

The manual has three sections. The first section describes installation, gives an overview of the program's uses and capabilities, and provides a command summary. The second section is a four-part tutorial that describes all the necessary steps to operate the program. It includes actual practice sessions and example files. The third portion provides information on disk file formats and error messages.

The manual guides you through a quick and easy training session in which you set up a bookkeeping system, manage it, and manipulate the figures and categories. You won't have to be a mathematician to understand and implement the tutorials, and you'll be using the program like a pro before you know it. Chuck Tesler wrote the manual himself and he did a fine job.

Using Tallymaster

Tallymaster isn't designed to keep track of individual checks or sales, but to define and manipulate groups. It lets you define categories meaningful to you, rather than to your accountant. Tallymaster provides 27 worksheets, each of which contains up to 26 categories—a total of 702 categories and subcategories.

Since you can manipulate worksheets between different files, you have access to an unlimited number of categories. You don't need to use, or even store, all the categories. You only work with the ones you define. If you need to increase the number of categories during a session, specify a new category and it joins the others as if you'd defined it from the beginning.

The first worksheet, containing categories A–Z, acts as your totals page. You can total all subcategories (pages AA–ZZ) to the first page. Each subcategory page has its own totals and subtotals that figure into the overall picture on the first page.

You can generate monthly and quarterly reports easily by adding first pages together into one report file. This procedure is easier done than said—it's fast, easy, and useful.

Defining a category is simplicity itself: Type the one- or two-letter ID and a name for the category. The category is automatically added to the file. Suppose you want a main category of travel expenses. Type A TRAVEL and press enter. The program adds the travel expense category to the first category on the first page.

If you want to separate the travel expenses, go to page AA by typing AA. Define the subcategories in the same fashion as the main category. AA GASOLINE sets up a category for gas, AB TIRES sets up a category for tires, and AC TRIP TO RIO sets up a category for the trip. You can change subcategories every month if your expenses change.

You can add, clear, or change categories at any time. You can even retitle them without changing the values they contain. All that remains the same is that subcategory page AA always totals to category A, subcategory page BA always totals to category B, and so on.

As an added feature, if you don't want to total a specific category or

group of categories, you can selectively skip them. This makes it possible to keep separate categories or pages of categories in the file, but out of the cumulative total.

To add an amount to a category, type the ID and the amount; the sum and two subtotal levels appear immediately. To subtract an amount, follow the same procedure but precede the amount with a minus sign. See Fig. 1 for an example of a Tallymaster work sheet.

The subtotals on subcategory pages are continuously updated on the specific page, but they are not totaled in the main category unless you give the total instruction. You can total these subtotals on the main page at any time and the program only totals them once.

For example, if you have a subcategory for computer software and you buy a $100 software package, you subtract that $100 from the main category when you total. After totaling, that $100 purchase still shows in the subcategory, but will not be subtracted the next time you total.

Tallymaster does more than add and subtract numbers. Its features include defining expense and income categories; adding and subtracting numbers to each category; totaling all or selected subcategories to the main work sheet; saving results to disk and retrieving them later; printing reports, using selected information; printing bar graphs in reports; combining ranges of categories and files; moving, duplicating, deleting, and zeroing categories; performing a limited variety of arithmetic operations; and developing simple projections.

Tallymaster is menu driven. Fourteen primary commands are available from the main menu (see Fig. 2), which you can conveniently access from a work sheet by pressing break or enter. You also press break or enter to get from the main menu to the work sheets.

The Help command gives rather complete instructions in 21 different areas. The text for the first topic is 10 screens long. Again, use break to exit the Help file.

See Figs. 3a and 3b for the secondary menus for the Math and Move, and Sequence/Sort commands. Work sheet amounts normally appear in decimal (dollar and cents) format, but the Integer command shows numbers as integers (useful for unit sales) and the Percent command shows them as percentages of the overall total.

```
A : PERSONNEL          34851.53 | E : OFFICE SUPPLIES        0.00
B : MARKETING          20907.66 | G : EQUIPMENT MAINT.       0.00
S : TAXES              12009.14 | N : LOAN REPAYMENTS        0.00
C : OFFICE SPACE        4955.00 | I : PRODUCT MATERIAL       0.00
J : POSTAGE             4212.41 | R : REFUNDS                0.00
D : OFFICE UTILITIES    3376.95 | O : ACCOUNTING             0.00
H : AUTO/TRAVEL/MEAL    2054.36 | T : CORP. SAVINGS          0.00
L : DP EQUIPMENT         673.00 | U : INVESTMENTS            0.00
P : LEGAL                535.00 | V : BAD DEBTS              0.00
Q : SUBSCRIPTIONS        469.00 | W : DONATIONS              0.00
F : OFFICE EQUIPMENT     219.00 | X :                        0.00
K : DP SOFTWARE          139.95 | Y :                        0.00
M : DP MAINTENANCE        90.00 | Z :                        0.00
            sub-total:    84493.00                  --more-->
CATEGORY, AMOUNT/DESCRIPTION ==> .
TOTAL:  114178.27; 0 ENTRIES; 92 ID'S; LATEST:
```

Figure 1

```
<*> <*> <*>  TALLYMASTER  (c) 1983, PROSOFT  <*> <*> <*>

        TO RETURN TO THIS MENU LATER ON, PRESS <BREAK>

H - HELP (INSTRUCTIONS)          | R - READ WORKSHEETS FROM DISK
$ - DISPLAY AS DOLLARS & CENTS   | W - WRITE WORKSHEETS TO DISK
% - DISPLAY PERCENTS OF TOTAL    | A - ADD A FILE TO WORKSHEETS
I - DISPLAY VALUES AS INTEGERS   | S - SEQUENCE/SORT CATEGORIES

M - MATH AND MOVE                | Z - ZERO VALUES
T - TOTAL SUB-CATS TO 1ST PAGE   | C - CLEAR NAMES AND VALUES
P - PRINT                        | Q - QUIT (EXIT TO DOS)

        ( ANY OTHER KEY TAKES YOU TO THE WORKSHEETS )

SELECT BY LETTER OR SYMBOL ==> ? .
```

Figure 2

```
MATH / MOVE:
 C - Copy one range to another (duplicate)
 R - Relocate a range of categories (move)

 A - Add SOURCE range TO TARGET range
 S - Subtract SOURCE range FROM TARGET range
 M - Multiply TARGET range by SOURCE range
 D - Divide TARGET range by SOURCE range

 K - Multiply TARGET range by constant from KEYBOARD
 V - Divide TARGET range by constant from KEYBOARD

 H - HELP
 / - CANCEL
                Select by letter ==> ? .
```

Figure 3a

Tutorials

A series of four tutorials provides the user with excellent examples of Tallymaster's operation as well as experience utilizing the majority of available commands. The first three tutorials develop a "Quarterly Summary of Expenses" in three stages.

A one-page summary, by major categories, for one month is the EXAMPLE1 file on the disk. A multi-page

```
These sequences are available:

D - Descending by value
A - Ascending by value
N - alphabetical by Name
I - ascending by category I.D. (normal)
H - HELP
/ - CANCEL

Select by letter ==> ? .
```

Figure 3b

SUMMARY OF EXPENSES, 4TH QUARTER, 1982 Page 1

	TOTAL	OCTOBER	NOVEMBER	DECEMBER
A : PERSONNEL	34851.53	11977.65	12064.62	10809.26
B : MARKETING	20907.66	7909.00	7401.16	5597.50
S : TAXES	12009.14	3960.71	3680.53	4367.90
C : OFFICE SPACE	4955.00	1705.00	1625.00	1625.00
J : POSTAGE	4212.41	1390.28	1296.96	1525.17
D : OFFICE UTILITIES	3376.95	1051.01	1088.87	1237.07
H : AUTO/TRAVEL/MEAL	2054.36	816.62	562.18	675.56
L : DP EQUIPMENT	673.00	608.00	35.00	30.00
P : LEGAL	535.00	125.00	260.00	150.00
Q : SUBSCRIPTIONS	469.00	22.00	390.00	57.00
F : OFFICE EQUIPMENT	219.00	0.00	144.00	75.00
K : DP SOFTWARE	139.95	120.00	0.00	19.95
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N : LOAN REPAYMENTS	0.00	0.00	0.00	0.00
I : PRODUCT MATERIAL	0.00	0.00	0.00	0.00
R : REFUNDS	0.00	0.00	0.00	0.00
O : ACCOUNTING	0.00	0.00	0.00	0.00
T : CORP. SAVINGS	0.00	0.00	0.00	0.00
U : INVESTMENTS	0.00	0.00	0.00	0.00
V : BAD DEBTS	0.00	0.00	0.00	0.00
W : DONATIONS	0.00	0.00	0.00	0.00
** TOTALS **	84493.00	29685.27	28638.32	26169.41

Figure 4

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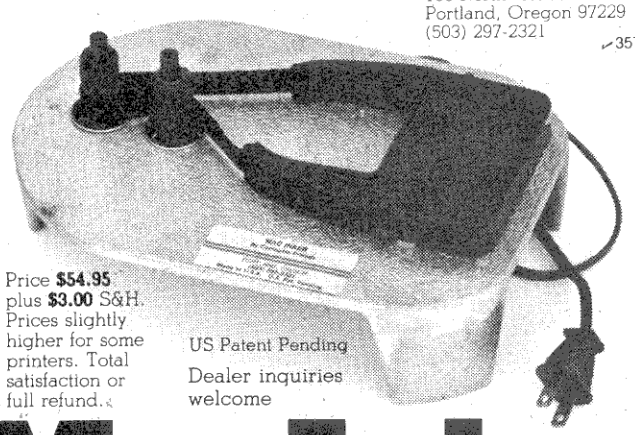

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breakdown of each major category, still at the monthly level, is the EXAMPLE2 file. Finally, the EXAMPLE3 file develops a multi-page quarterly summary using the high-level totals from three individual months. The third file uses Tallymaster's ability to load previously saved data into different work sheet locations.

The Print command gives you a printout of the results, as in Fig. 4. The Print command is a relatively limited report generator, but it's simple to use and presents the desired information in a clear, useful format.

The fourth and final tutorial uses the Math/Move facilities to develop a "Sales Summary and Projection." In the EXAMPLE4 file, the range of categories exceeds a single work sheet and the tutorial shows how the program handles and manipulates them. Developing this sales summary is a complex task involving multiplying by a constant, adding two ranges of categories together, and multiplying two ranges together.

```
ESTIMATED SALES REVENUES — OCTOBER, 1982                Page 1
                              TOTAL   ...10...20...30...40...50...60..
A : FOOTWEAR                 5089.50  ********************
C : JACKETS                  1622.50  ******
D : SHIRTS                    756.00  ***
B : SLACKS                   3503.60  ***************
E : TIES                      698.68  **
    ** TOTALS **            11670.28
```

Figure 5

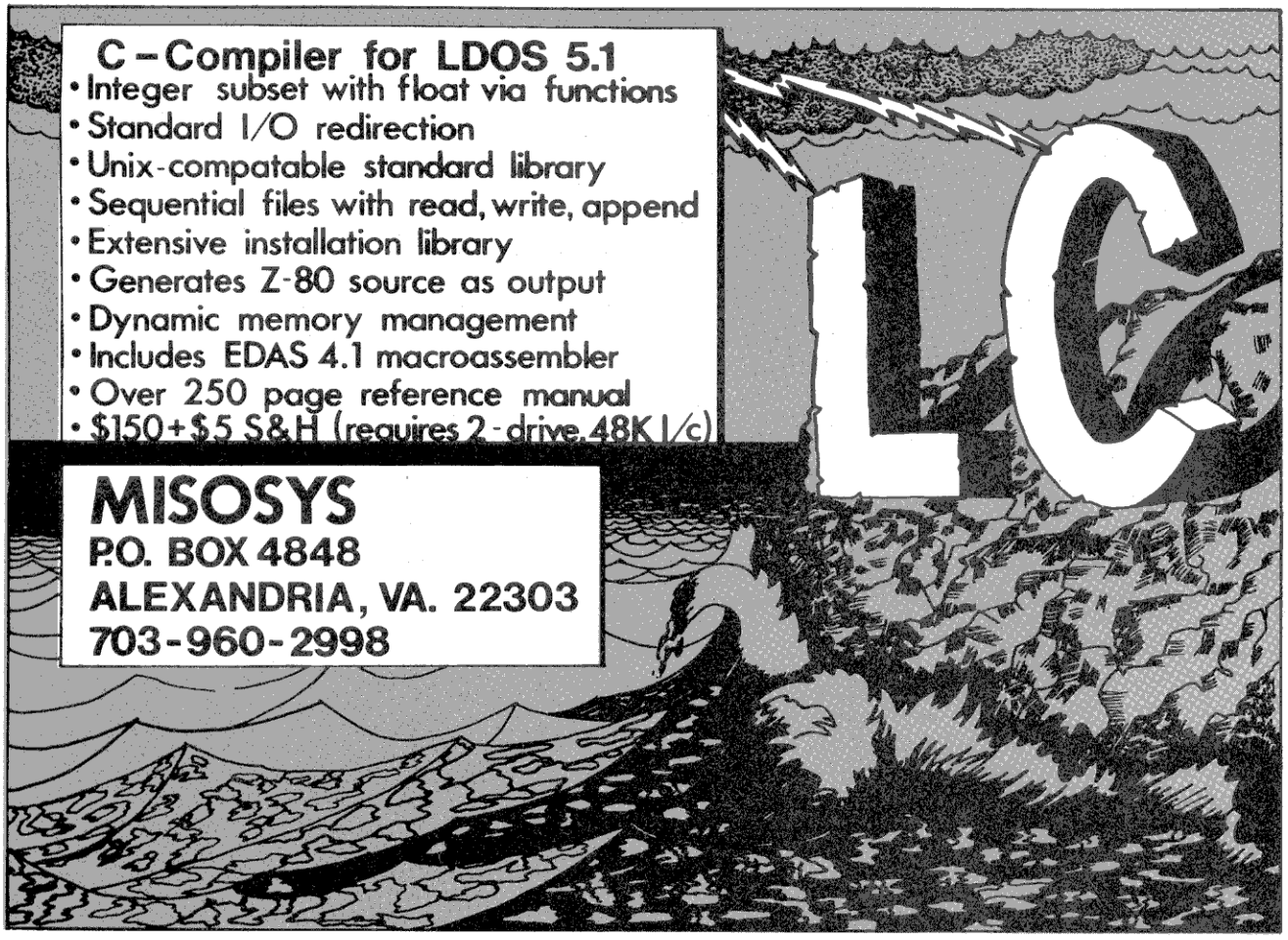
The completed sales summary provides information on unit sales by product, prices by product, and approximate revenues by product. If you only require a revenue projection in report form, the Print command provides totals and a bar graph (see Fig. 5). Be aware that the tutorials are only guides and you can apply the techniques as you wish.

By the time you've used these tutorials, you are ready to modify the examples in the tutorials or set up a system from scratch for your own use. It's amazing how quickly you can master Tallymaster. You don't need a text book and a two-semester night school course.

Reservations

Nothing is perfect. Tallymaster's Help command is too detailed for me. The amount of information in the Help file slows you down even when you're in the learning stage. The manual is a better place for detailed information.

Tallymaster's price is certainly fair, although some people might wonder about spending this much for what appears to be a simple program. Ac-



See List of Advertisers on Page 355

tually, Tallymaster has tremendous depth and is well worth the money.

I also noticed that there appears to be a difference between computers that causes the break and enter keys to vary. Tallymaster's menus state that the break key switches pages. On two of the computers I have access to, a Model I and a Model III, break has no effect and I have to use enter instead. This isn't a problem, but it is contrary to the instructions. On my other Model I, the break key works as it should.

Recommendations

You should know that Prosoft is noted for their fine software support. They are polite and helpful, and will answer your questions to your satisfaction.

Tallymaster has cut my bookkeeping time by about a third. I can do my quarterly taxes in half the time I needed before, and I save at the end of the month when I balance the books. It's all done in seconds! I still keep a set of written books, but I have balanced to the penny every time I've compared the two.

I recommend Tallymaster to every user who wants a good, easy, accurate bookkeeping system, and to anyone interested in home or small business budgeting and bookkeeping. It provides all the necessary features. If you've been looking for just the right program to handle your bookkeeping work, give Tallymaster a try. ■

★★★★
The Epson FX-80
Epson America Inc.
3415 Kashiwa St.
Torrance, CA 90505
$695
by Dan Bishop

When I received my new Epson FX-80 printer (see photos), I was anxious to see how it compared with the earlier MX-80 and MX-100 printers.

The printer came out of the box in five parts, including a 190-page operator's manual, an ink-ribbon cartridge, the printer, a hard plastic separator (to snap behind the platen to separate the incoming paper stream from the outgoing stream), and a plastic printer lid that prevents paper entanglement and reduces printer noise. The printer does not come with a connect cable for the computer; order this for the specific computer you plan to use with the printer.

Epson's new FX-80 printer.

Except for its height, the FX-80 is somewhat larger than the MX printers. It weighs 16.5 pounds and measures 16.5 inches wide, 13.7 inches deep, and 3.9 inches high. It comes with the standard Centronics-style 8-bit parallel male connector, although other common printer ports are available. The printer is enclosed in a cream-colored hard plastic case.

The FX-80 supports both friction-feed and tractor-feed applications, as long as your fan-fold paper's sprocket holes are between 9.5 and 10 inches apart. The optional tractor-feed attachment accommodates paper widths from 4 to 9 inches.

Once the pin-feed sprockets are adjusted for paper width, loading the paper is almost effortless. Hand-feed paper (from the top, center) down behind the roller until its advance is blocked. Use the line-feed button to guide it until it comes around to the front, already engaged in the sprocket pins. A roll paper holder is optional.

Beware of CPS

The first thing I did when I hooked the printer up to my computer was to run several print-speed tests. After all, one of the FX-80's selling points is its print speed of 160 cps—twice that of the MX-80 and MX-100 printers.

Figure 1 shows the resulting print speeds I obtained, using a three-line

Continues on p. 45

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Continued from p. 42

Basic program to print out 100 lines of text containing 80 characters each, using some of the different print modes available on the FX-80.

The results disturbed me enough that I decided to time the print-out rate for the self-test diagnostic built into the printer. This bypasses the computer entirely. Unfortunately, the results were the same. This made me question the actual print speed for the older MX series. I hooked up an MX-100, rated at 80 cps, and ran the same Basic program I used before. The MX-100 operated at just under 60 cps! So, while the FX-80 doesn't even approach the 160 cps advertised, it is about 2/3 again as fast as the old MX series.

New Features

The FX-80's dot matrix grid is increased from 9 dots by 9 dots to 11 dots (wide) by 9 dots (high). This new pattern accommodates one of the more exciting features of the new printer—proportional spacing. The letters i and l occupy less horizontal space on a line than before; conversely, letters m and w use more space. The resultant copy looks neater and more professional than the MX type.

The "emphasized mode" also improves the text's appearance. This feature is preset by positioning one of the readily accessible DIP (dual in-line package) switches, so the printer defaults to emphasized mode when you turn it on. Or, it can be selected with a software command from the computer.

While print speed is sacrificed in the emphasized mode (see Fig. 1), it produces higher quality print by striking each line of print twice. This darkens the characters and widens the dots so that more overlap occurs, improving character resolution.

The "double-strike mode" is a different approach to enhancing the appearance of printed characters. Here again, a line of print strikes a second time over the first, but only after the paper is advanced 1/216 inch. This virtually eliminates spaces between the dots. And for a truly bold effect, use both emphasized and double-strike features.

As with the MX printers, the FX-80 lets you define a variety of print sizes. The four commonly used sizes are condensed (132 characters per line [cpl], normal [80 cpl], condensed enlarged [68 cpl], and enlarged [40 cpl]). Since subscripts and superscripts are supported, you can combine one of the optional character fonts with the subscript/superscript mode to produce several sets of "super-compressed" characters as well.

The FX introduces a new feature, the "elite" size type that prints in either normal mode (96 cpl) or enlarged modes, (48 cpl). Add these sets to the italics character sets and your printer almost doubles as a typesetting machine. See the sample lines in Fig. 2.

The addition of 2K of built-in RAM on the FX printer lets you redefine any of the 256 possible CHR$ codes to correspond to a character of your own design. With these down-load characters (distinguished from the ROM characters described earlier), you can design a complete Greek or Russian alphabet set and store the customized character set in RAM. Switch back and forth between the sets at will.

Any figure or design can be stored as a down-load character. Since the ROM character set is also easily transferred to the down-load area of RAM, you can redefine only one or two of the normal characters, and keep all of the rest intact.

The ROM character generator built into the FX offers nine different nationally oriented character sets. For example, the French set gives you an accented a and u, two accented e's and a c circumflex, while the Spanish set gives you an inverted question mark and an n tilde. Other foreign-language character sets include Italian, German, Swedish, Danish, and Japanese.

Figure 3 shows some of the international characters defined in FX ROM. Use the Backspace command to backspace over a letter and insert a caret, tilde, or umlaut.

Another useful feature is a command that lets the printer interpret CHR$ codes from 0–31 and from 128–159 as printable characters rather than control codes. This defines down-load charac-

Normal Pica Mode:	98 cps
Normal Pica, Double Strike :	35 cps
Normal Pica, Emphasized :	25 cps
Compressed Pica :	97 cps

Fig. 1. Results of timing tests with the FX-80 and MX-100 printers.

```
This is an example of normal ELITE size print.
This is an example of normal PICA size print.
This is an example of normal PICA ITALICS print.
This is an example of normal ELITE ITALICS print.

This is an example of double-strike normal ELITE print.
This is an example of double-strike normal PICA print.
This is an example of emphasized normal PICA print.
This is an example of emphasized, double-strike normal PICA print.

This is an example of compressed subscript print.
This is an example of normal subscript print.
This is an example of compressed enlarged subscript print.
This is enlarged subscript print.

This is an example of compressed normal PICA print.
This is an example of normal PICA print.
This is compressed enlarged PICA print.
This is enlarged PICA print.

MMMM WWWW iiii llll Normal sized emphasized PICA print.
MMMM WWWW iiii  llll  Proportionally spaced emphasized PICA print.
```

Fig. 2. Sixteen of the more than sixty different combinations of print size, print font, and boldness characteristics available with the Epson FX-80 printer. Note especially the quality of the double-strike elite, the emphasized pica, and the proportionally spaced emphasized pica examples.

```
Ääà Ääà ÅàÅà ÆæÆæ
Ééè Ééè ìì ¡/ ÞÞ
òò ÖÖÖÖ ØøØø ¤¤ ÜÜÜÜ
ÑÑÑÑ ¿¿ ç ¥¥ ££ ßß
^ ` §§ ~ ¨ °
[] \ {} ¦[] \ {} /
```

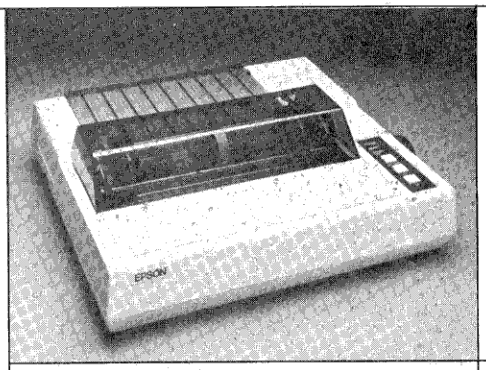
Fig. 3. Examples of international characters built into the Epson FX-80 ROM Character Generator.

ters using CHR$ codes not normally available.

Additional Text Features

As with the MX series, you have complete software control over vertical spacing by specifying when the printer receives a line-feed instruction. Similarly, the left and right margins can be specified using software control, as can the horizontal tabs.

The FX has a reverse-feed capability; you specify how many 216ths of an inch you want the paper to move backwards. This gives you a tremendous amount of latitude in format control for special effects and the like.



". . . any software written for the MX printers should work on the FX-80."

Graphics

The Graftrax package is a standard feature with the FX series. It has complete pin-fire control, making it possible to construct intricate dot-imaging graphics. In fact, this Graftrax package is expanded beyond the original's capabilities.

Where the MX series let you define graphics using 8 pins, the FX printer gives you the choice of defining graphics using either 8 pins or 9 pins. This choice makes the FX compatible with the software written for the MX, providing even greater versatility for the FX programmer.

Two additional commands are available for the FX as well. One doubles the speed of dual-density, bit-image graphics. The other command prints graphics in quadruple-density mode. Bit-image data can appear at 1,920 print positions per 8-inch row.

Conclusion

As far as I can determine, all of the commands available on the MX-80 and MX-100 are identically defined with the FX-80. Thus any software written for the MX printers should work on the FX-80.

While the documentation is not intended for beginners, it is a definite improvement over the MX-100 manual that first appeared on the market. A call to California assured me that Epson was working diligently to produce revised manuals to accompany the FX printers. However, if you have worked with CHR$ codes before, the current instruction manual should present no problems.

The FX-80 printer is not as fast as I had hoped, but the added functions convince me that the new FX-80 is a worthwhile upgrade of the MX series printers and is well worth the list price of $695. ■

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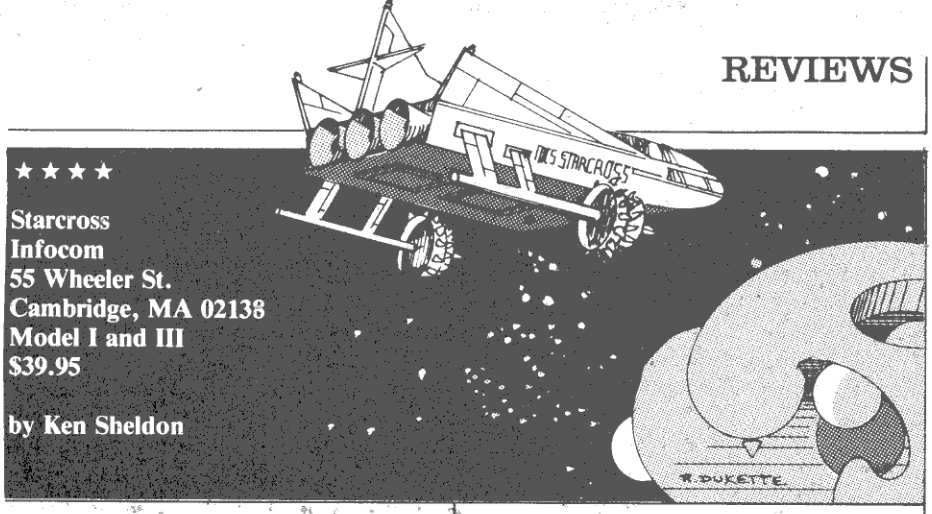

★★★★

Starcross
Infocom
55 Wheeler St.
Cambridge, MA 02138
Model I and III
$39.95

by Ken Sheldon

It is the year 2186. You are aboard the mining vessel Starcross, in search of rare black holes you hope to harness to provide energy for civilization and cash for you. You are the captain and sole voyager on the Starcross, with the exception of your ship's computer.

Suddenly, the mass-detector alarm goes off, alerting you to a nearby mass. This could be your big break. On the other hand, it could be the beginning of a wild goose chase, the likes of which are enough to make you swear off black-hole mining forever. It depends on how well you play the game.

The game is Starcross, Infocom's first science-fiction adventure game. It comes in an innovative flying saucer-shaped package that includes a map of the galaxy and necessary directions. Like Infocom's other games, Zork I and II, Starcross requires a TRS-80 Model I and III with 32K of RAM and a disk drive. It is designed to let you respond with complete sentences, rather than just one- or two-word commands. Starcross has an impressive vocabulary, even though it occasionally tells you that it doesn't understand a certain word, even when it has just used the word itself.

As you begin your adventure, you receive assistance from your on-board computer, an obstreperous piece of machinery that insults you if you act against its advice, ignores you if it feels like it, and corrects your language when you curse it.

You must address the computer directly by saying, for example, "Computer, what is our status?" or "Computer, set course for Mars," and so on. This becomes tedious after a while.

Navigating the M.C.S. Starcross is tricky at first; a special notice has been added to the package to explain it more fully.

Once you arrive at the mysterious mass, the real fun—and frustration—begins. The mass, you discover, is not a black hole after all, but a huge space vessel containing several small worlds and a variety of bizarre alien creatures. They include an enormous, talking spider (that is as boring as he is large), an alien chieftain (with an eye for your spacesuit), and a giant slithering grue (*Grue Vulgaris*) that kills you if you accidentally stumble into its lair.

Upon entering the vessel—and this takes a little time—you discover that the ship and its inhabitants are in some kind of trouble. You must figure out what is wrong and correct the problems before it's too late.

As you play, the game records your moves and gives you points for making the right ones. When you leave the game or get killed, it ranks you based on how well you performed. Rest assured, you will be a Space Cadet for a long time before you complete the game.

There are a few things to remember while playing Starcross. You should learn how to use the commands that let you save and restore a game position so that you won't have to start from scratch every time a move gets you killed or leads you to a dead end.

Although Starcross is loaded with descriptive detail purely for literary value, many of the material objects presented have some significance to the game. If anything is presented that you can pick up and take with you, take it—just in case.

Since all the action in this game takes place aboard spaceships, your movement is denoted by Fore, Aft, Port, and Starboard commands. This takes some getting used to.

The package states that the game takes about 35–40 hours to complete, and you will undoubtedly pull out your disk in disgust many times before you reach the end. But, this game is a masterpiece of sophisticated programming, with enough challenge, variation, and adventure to keep you coming back for a long time. ■

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Mark Renne
Review in 80 U.S.

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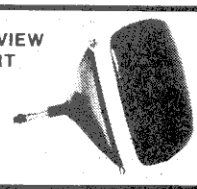

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BT-1020 Real Time Clock/Calendar
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BT-1000
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Basic Technology
P.O. Box 511
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by Scott Norman

Two Color Computer add-ons make intelligent use of the bus signals available at the Color Computer's cartridge port. The BT-1000 Expansion Interface lets you attach up to five peripherals to the bus (disk controller, ROM packs, or experimental boards).

The BT-1020 Real Time Clock/Calendar keeps track of time, day, and date. You can continuously display this information, record it on FLEX data files, or use it in real-time control applications.

These well-made Basic Technology products have solder-masked printed circuit boards, gold plated connectors, and other nice touches. You can use the BT-1020 independently of the BT-1000, but you'll probably need both for sophisticated control applications. I'll start with the BT-1000, the heart of the system.

The BT-1000 Expansion Interface

You can think of the BT-1000 as a straightforward extension of the Color Computer's bus, providing five additional sockets housed in a gray plastic enclosure. The box also contains a power supply, sockets for additional RAMs, and memory decoding circuitry.

It connects to the Color Computer via a 40-conductor cable whose free end terminates in buffered-drive circuitry. This end is housed in a cartridge that plugs into the computer's ROM pack slot.

Memory decoding is the real key to the BT-1000's power. In the normal memory map of a 32K Color Computer, everything up to address 32767 (7FFF hexadecimal [hex]) is RAM available to the user.

The next 16K belongs to the Color Basic ROMs, and the cartridge port addresses occupy yet another 8K, 49152–57343 (C000–DFFF hex). (That leaves 8K unaccounted for in the 64K address space of this machine, but that's why you have FLEX.)

That limited address space is where the trouble begins. You can't hang a bunch of peripherals onto the cartridge port, wire them in parallel, and expect good things to happen.

As soon as the computer tries to access any address between C000 hex and DFFF hex, each of the outboard chips tries to put its own data onto the bus. This is called bus contention, obviously a no-win situation. At best, one memory chip might have a sufficiently strong signal to override the others and get its data through to the CPU.

But how could you guarantee that that was the chip you wanted to read? Furthermore, it's possible to damage the weaker chips in the fight.

Any CoCo bus expander must settle such disputes and designate a particular peripheral as the real location of any specified address, with the ability to change this assignment under operator or program control. That's what memory decoding is all about.

The BT-1000 handles this in several ways. A small toggle switch on the left side of the unit determines whether the BT-1000 or the Color Computer itself handles the decoding above C000 hex. You might leave memory decoding to the computer if you use FLEX or the new CoCo utilities. Their all-RAM Type 1 memory configuration requires computer control.

The toggle switch is not well marked on the BT-1000 review sample. The manual is fairly clear, but the setting positions should be marked on the case itself.

The BT-1000's expansion slots are numbered 1 through 5, with the first slot nearest the input cable connector. Since the BT-1000 plays an active role in memory decoding, the slots are not wired identically.

For example, only the first slot connects to the CART signal (interrupt input that detects the presence of a cartridge) at pin 8 of the expansion connector. If you have a ROM pack or other peripheral intended to autoexecute, the first slot is the place for it. The disk controller is a common candidate for this

position, although it is not an autoexecution cartridge.

Since the other four expansion slots lack the CART connection, cartridges plugged into them have no immediate effect when you turn on the CoCo. If such cartridges contain ROMs, you can copy their contents into RAM or examine them where they stand. You can execute any programs they contain with an appropriate EXEC command, taking precautions to avoid bus contention.

Such precautions involve another signal line that the expansion slots do not share equally. This is the chip enable, CTS, located on pin 32 of the connector. Normally, it decodes addresses between C000 hex and FEFF hex (decimal 65279) and turns on the appropriate ROMs in a program pack. When the BT-1000 is activated, however, the CTS lets the user select one of several peripherals.

Jumpers within the BT-1000 let the user separate expansion slots 1, 2, and 3 from 4 and 5 as far as the CTS signal is concerned. The memory map's upper 16K is divided into a pair of 8K segments, referred to as CTSLO (sockets 1, 2, and 3, addressed at C000–DFFF hex) and CTSHI (sockets 4 and 5, E000–FEFF hex).

Alternatively, you can decode the CTSHI addresses as belonging to an additional quartet of 24-pin integrated circuit (IC) sockets within the BT-1000. You can populate these with 4K by 8K EPROMs, or 2K by 8K EPROMs, or RAMs.

The CTS signal activates a particular chip. Whether it responds to a particular range of addresses depends on its internal structure. That's why you can put 2K or 4K chips into the same socket.

The BT-1000 contains several jumpers and DIP (dual in-line package) switches that designate the memory map in use. The manual is fairly clear on their interaction, although it requires more back-and-forth paging than I'd like.

With a little planning, the user can partition the upper end of the CoCo's memory range into several easily managed segments. He can then employ them for disk controllers, parallel printer interfaces, resident monitors or other utilities, and for experimental boards to interface with the outside world.

This is no small achievement; the Color Computer is not designed for control applications, and its bus is neither standard nor readily accessible.

The BT-1000 is not for the beginner. It requires reasonable familiarity with digital electronics to realize its benefits. This is particularly true to avoid conflicts between the Radio Shack disk controller and other peripherals due to incomplete internal address decoding of the controller's registers.

The BT-1020 Real Time Clock/Calendar

You can use the BT-1020 with the BT-1000 or plug it directly into the Color Computer's cartridge port as a stand-alone peripheral. At the least, it adds a touch of big-machine class to the CoCo's operation. When exercised, it plays an important role in real-time monitoring and control applications.

The BT-1020 is housed in an enlarged ROM pack cartridge like that of the Radio Shack disk controller, and is built around the Motorola MC146818 IC. The computer's 5-volt power supply operates it, although after eight hours of operation its internal NiCad battery is sufficiently charged to operate the unit independently for about two weeks.

Major features include:

- Time, day, month, and year displays with 12- or 24-hour options
- 100-year calendar with leap-year compensation
- Daylight savings time compensation
- Periodic alarm feature
- Time and date information available from specific RAM locations in binary or BCD formats
- Maskable interrupts available at specified times of day, at specific rates, or at the end of the clock update cycle
- Relocatability via jumpers on the PC board.

As received, the BT-1020 is configured to occupy addresses FEC0–FEFF hex, although with a pair of internal jumpers you can move it to any one of four 64-byte blocks with starting addresses between FE00 hex and FEC0 hex.

The BT-1020 provides 50 bytes of available RAM and 14 bytes devoted to time, data, and control information. The MC146818 has four internal registers that control the mode of operation and can determine the unit's status.

To demonstrate typical applications, a sample cassette with three programs is included, together with complete source code listings.

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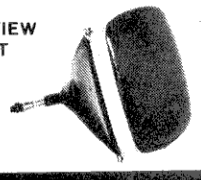

FOR THE FULL STORY SEE PAGE 43

Langley-St.Clair Instrumentation Systems, Inc. -462
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Timeset is a Basic program that initializes the time and date when the BT-1020 goes into operation. It prompts the user for the order and format of the information. For instance, 2:15:30 PM appears as 14/15/30.

You must experiment when using this program, since the number of prompts makes it difficult to get the BT-1020's clock off to an accurate start.

Timerd is also written in Basic, although it contains data statements used for a machine-language subroutine to read the time and date registers. Once you load Timerd, the Run command displays the time, day, and date in the upper right corner of the screen. There is one such display per run.

The third program, Shwtimb, is in machine language. It continuously reads the BT-1020 and displays the updated time and date in the upper right corner of the screen. The registers are updated every quarter of a second, although the time display changes only once a second.

The display is in reverse video, with the format for 2:57:06 PM on March 26, 1983 taking the compact form:

14:57:06
03/26/83

The program is written in position-independent code, so you can load it into high memory and leave it there.

You can leave Shwtimb running while you write Basic programs. A long program line will not overwrite the time/date display on the screen, but information entered from the keyboard while programming makes its way safely into RAM.

Switching to a graphics mode eliminates the BT-1020 display, but the real-time clock continues to run. The display returns as soon as you re-establish the text mode (by breaking a graphics program, for example). Once Shwtimb is executed, you can halt it only by resetting the interrupt enable through a specific PEEK/POKE combination detailed in the manual.

The program listings and documentation provide the user with the elements for adapting the BT-1020 to timing and control applications. In Basic, you must interrogate the memory location corresponding to the BT-1020 register of interest, AND or OR the data with a suitable bit mask, and make some decision based on the result.

Summary

Like the BT-1000, the BT-1020 is most effectively used by those with some knowledge of the Color Computer's inner workings. Many hobbyists have such knowledge, and I'm not suggesting that these products would interest only computer engineering professionals. But their implementation is complicated.

The products are generally well made, and the documentation is sufficient to give you a good start. Given some degree of experimental inclination, you can significantly expand the flexibility of your Color Computer. ■

★★★★★

SeeBee (For Model II)
Systems Enhancement Engineering
P.O. Box 40215
Indianapolis, IN 46240
$59.95 plus $3 shipping

by Charles R. Perelman

SeeBee (Systems Enhancement Engineering Boot Error Eliminator) is a blessing for vintage Model II owners, specifically those who have 32K units with a serial number before 32001700 and 64K units with a serial number before 64036930. Radio Shack began correcting a Model II boot-up problem in mid-1982, but local Radio Shack dealers estimate the cost to upgrade at a minimum of $120 to install a replacement board and cable. If your TRSDOS manual advises you to insert a terminator plug in your extra disk port and warns you that your expansion drives must be turned on before booting a disk, you need SeeBee.

The alternative is to plug SeeBee into the computer port, and your cable from the expansion drive into SeeBee. No additional parts, cables, or installation are required. You no longer get boot errors, and the noise level is reduced because the extra drive isn't running.

With SeeBee, if your program tries to access another drive, TRSDOS error message 8 warns you that the expansion drive is not ready. (In CP/M you get a similar result.) Switch on the other drive, insert the disk and continue without incident. You save wear and tear on additional drives while you work solely

Continues on p. 53

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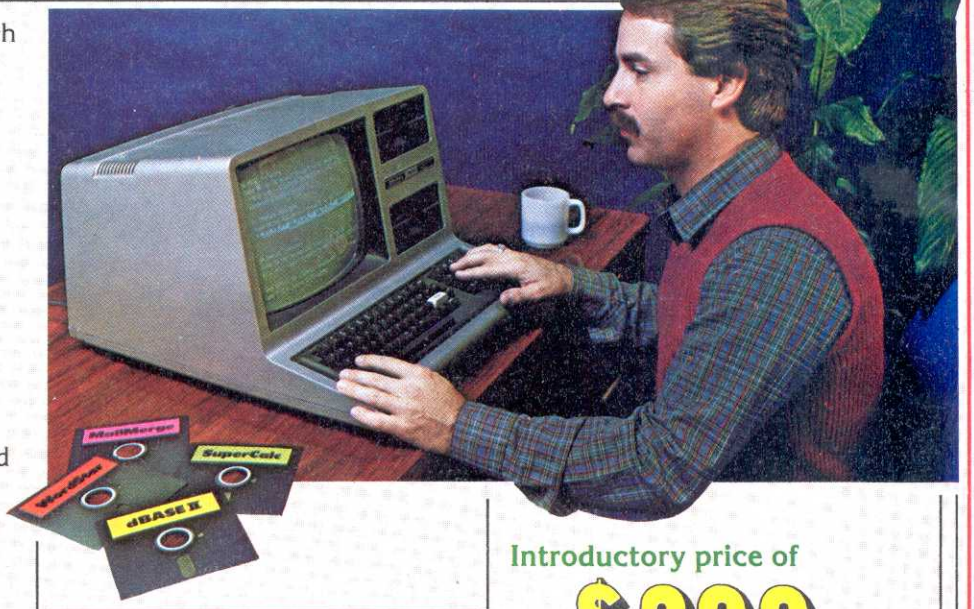

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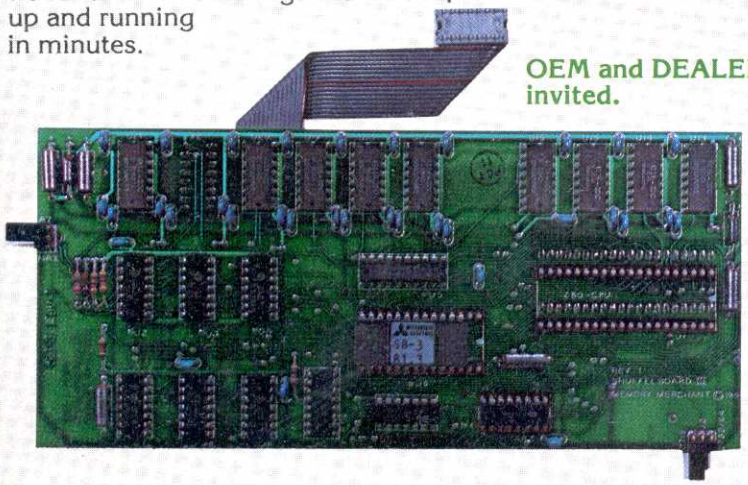

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Continued from p. 50

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Model I and III

by Wynne Keller

ENBase (ENB), formerly called Electric Notebook, is the first inexpensive relational data base marketed for the Models I and III.

Relational data bases have a unique, logical approach to data structure: They consider the fields of an ordinary data base as sets of related data. Data is tied together according to your specifications, rather than by an arbitrary record number that the program assigns. No repetitious data uses up valuable disk space, but relational data bases are slow.

ENB comes on a formatted disk that runs with TRSDOS. A convenient utility program on the disk rapidly transfers the data base programs to your TRSDOS system disk.

Owners with only one drive can use ENB. Unlike many data bases, ENB is pleasant to use on a single drive. Prompts appear for switching disks, and once you load the program, you don't need to change disks again.

ENB is supposed to work with most operating systems; however, some problems with DOSPLUS have not yet been resolved. I used the program on NEWDOS80.

Data Structure

Organizing your data correctly is crucial, and sometimes difficult. I'm going to explain organization in considerable detail, to clarify the differences between ENB and other data bases I have reviewed. I'll discuss cataloging a mineral collection as an example.

A mineral has a name, perhaps quartz. It was found at a particular location. You describe the location using a mine or quarry name, which is in a county, in some state, in a country.

To keep records on the collection, you assign a unique number to each specimen. In a conventional flat-file data base, each category represents a field. In a relational data base, each is called a set.

Suppose you have 10 specimens from Dunton Gem Quarry in Oxford County, Maine. To complete an entry for the first specimen, you must include all the information. On the second specimen, ENB's differences become apparent.

". . . ENB allows data manipulation that would be impossible in many other programs."

In a regular data base, the second specimen requires an entry in every field, just like the first. In ENB, you need only the specimen number, specimen name, and mine name. The program recognizes Dunton Gem Quarry and therefore knows the county, state, and country are the same as before. It doesn't ask for them again.

Entering repetitive data in regular data bases is not as difficult as this description implies, because quality programs usually have a special keystroke sequence that automatically repeats previously typed data. The point here is not time saved, but disk space saved. Furthermore, the relational structure allows more flexibility.

One example of this flexibility is that you can approach data from any angle. It is possible to type in all the mine data at one sitting, then type in the names of various minerals some other day and link them together with the specimen numbers. You can use any set as a starting point to enter data, but some are not very useful depending on how the sets are linked during data-base initialization.

You can add a new set at any time, without harming or restructuring the existing data. Most data bases do not allow this, or make it difficult to accomplish.

If the initial minerals data base had no information on the size of each specimen, you could later add the set "Size" and link it to specimen number. Thereafter, the program requests the size each time you add a new number. You can also type in sizes for all the specimens already in the data base.

Finally, ENB allows data manipulation that would be impossible in many other programs. If a data structure problem seems to require two or more data bases tied together, a relational data base might solve the problem.

For example, Maine has many mineral sites. A particular group of minerals occurs at each location. Some of the minerals are quite rare and hard to identify.

I wanted to make a list of each mineral that could occur anywhere in the state, and maintain information to help identify it, such as color, hardness, and crystal form. In addition, I wanted a list of every quarry in the state, and all minerals known to occur in that quarry.

Ideally, the printout of minerals at each quarry should show the mineral names and the identification data for each on the same list. In most data bases, this set-up requires a lot of work. If tourmaline occurs in 25 locations, you would have to enter the identification data on tourmaline 25 times.

Such a task is not worthwhile—better to run this problem as two separate data

bases and shuffle printouts. With ENB, the project becomes feasible using sets for quarry names, mineral names, crystal forms, hardness, and description. ENB's features eliminate work duplication and provide printouts with the name and description of each mineral that occurs at a location.

Initialization

After planning the data structure on paper, you must initialize the program. I had no difficulty visualizing my sets and layout on paper, but molding the program to follow this layout was another matter.

The author of ENB provides a complete sample data base and a tutorial. The disk tutorial shows each data-base screen as it goes through the sample application of a school classroom schedule. If you have a question about what is happening, press clear at any time and you'll see a separate page of explanatory text.

Three disk tutorials explain using the program, setting up the program, and defining reports. In concept and execution, the tutorials demonstrate creative use of a computer to assist and instruct the user.

The manual is spiral-bound with a soft cover and has high-quality dot-matrix type. It includes a five-page index and a complete table of contents.

The first part of the manual explains the tutorial and describes the school data base in detail, with occasional examples of business applications like invoicing. This program was developed in England, so the school system is a little different from that in the states, but there's enough detail to make the example reasonably clear.

The manual includes hints for analyzing your own data structure and describes several pitfalls. Even so, structuring the data base is difficult, time-consuming, and frustrating. You have to try various approaches to find the one that produces the desired results. The trick is to select the proper features and define the correct relationships among the sets.

Each set's optional features include closed, datavalue, number, uppercase, and shorthand. You cannot add new members to a closed group. Datavalue means you can add members to the set freely, without a query from the program.

The number feature restricts entry to numerical data and associated special keys. The uppercase feature converts any entry to uppercase. Shorthand allows abbreviated entries for searches; "tourm" lets you find the set member tourmaline.

You define the relationship between one set and another by selecting the correct constraint. The four types of constraint are single, required, belongs, and secondary. For example, a city can have only one state, but a state has many cities. You define the set city as having an attribute (a related set) called state, which needs the constraint single.

The set state also has an attribute called city, but you cannot use single as a constraint because the state has many cities. This sounds clear enough on paper, but as you try to enter information into the program, it's easy to become confused about whether you're describing the connection from city to state or from state to city.

"Initializing this data base is difficult; it requires patience and determination, but the results are worth it."

If you use required as a constraint, you must make an entry when typing the data. Since each city must have a state, you might want to insist on one by placing the required constraint on the attribute state of the set city.

Belongs and secondary are even more complicated. These two attributes help establish parts of a group (belongs) and relationships that are unimportant (secondary).

After initialization, trial runs establish whether the data structure is correct. A typical problem might be getting the program to ask the right questions at the right time when you enter data.

As I typed specimen numbers into the program, I wanted to add the name and locale for each. At first, ENB asked for one number after another. If I misspelled a mineral name, the program automatically added it to the set without checking to see if the name matched previous data.

I eventually solved each of these problems and many more by changing features, constraints, and links among sets. Initializing this data base is difficult; it requires patience and determination, but the results are worth it.

Using the Program

ENBase is designed for accuracy and efficiency. You can make the program check data as you enter it. It is possible to add records from several directions—you can name any set as the starting point.

When you add to the set mine, the program asks you for a mine name. After you type it, ENB compares it with the mines already on file. If the mine is new, you can add it or back out.

If you misspell the name or capitalize a letter incorrectly, the program does not recognize it as a name on file. Back out and reenter the name correctly. If you think the program should recognize the name and you cannot see why it doesn't, request a list of the mines already on disk.

Once you add the mine, the program requests specimen numbers from it. Each number is checked as you type it, so you can be certain no duplicate numbers exist in the collection. (If you don't want the number-checking feature, initialize the set numbers to have the feature datavalue.) With each new number, you can enter a specimen name.

It's difficult to make errors with this system, but should one occur, you can fix it by entering the set involved and renaming the incorrect item. If the erroneous item is connected to more than one other item, the correction is made for all items.

In most data bases, if you have the wrong state initials for Arkansas, you would fix each affected record by selecting and correcting them one at a time. With ENB, a global change is unnecessary because only one Arkansas entry is on the disk, regardless of how many cities connect with it.

In a regular data base, deleting a record deletes all the information, not just one field. In ENB, the deletion of an item in one set triggers deletions in other sets. Some are automatic deletions, while others are optional. It depends on the connections established between different sets.

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data base. ENB places all items in sorted order as you enter them.

Math functions are virtually unavailable in ENB, except additions (totals) in a set during a report. However, a program to convert data for VisiCalc is on the disk. It is possible to send ENB data over to VisiCalc, perform calculations, and return the updated file to the data base.

This is far less convenient than doing simple calculations within ENB. An inventory application, for example, is difficult to implement since obtaining price times quantity figures or percentage markups is time-consuming.

You can send reports to the screen or a printer. The formats are versatile and fairly easy to establish. Alternatively, you can save them to disk for later reuse or editing.

When you first establish a set, you also specify a set width. This is the screen display width, not the number of characters you can type. The simplest reports use the screen display width for each set. However, as a screen is only 64 characters wide and a printer 80 or 132 characters wide, you might want to alter the display width for some reports.

If any item exceeds the allotted width, the program truncates it on the right side. If the number of characters selected does not fit on a single line, the excess is not printed; there's no wrap-around to a second line. You cannot print any multiple-line formats, such as labels.

This is a potentially serious flaw, although you wouldn't want to use this program for a mailing list anyway. If you need multiple-line reports, you must write a Basic program to access the data.

I especially liked the appearance of reports because there's no entry duplication. Groups of data stand out clearly. Selection of the first set for the report is very important because that set orders the data.

For example, to see all mines alphabetically, place the mine name first. To group mines by country and state, you must place the country set first. The report prints the country name, then each state alphabetically, then each mine in the state, also alphabetically. You can place sets in any order on the line.

You can use selection criteria for reports. This program has the most sophisticated selection criteria I have encountered in any data base. Virtually any complexity is allowed; any logic possible in Basic is possible in this program.

This includes logical AND, OR, NOT, range, greater than, less than, not equal to, equal to, instring, wildcard, and searches on the right side of a data string. The default search is a simple AND relationship among sets, so you don't have to understand the sophisticated searches until you need them. The manual is clear and you shouldn't have problems using this power when you need it.

"This program has the most sophisticated selection criteria I have encountered in any data base. Virtually any complexity is allowed; any logic possible in Basic is possible in this program."

You can specify the line at which printing begins by selecting some particular set member as the report's first item. You also control the number of lines per page and the pause at the end of each page. You can have page breaks whenever a new value is in a specified column, and you can total numerical columns.

ENB allows stopping in the middle of a report to manipulate data, a particularly useful editing feature. The data is grouped on the screen according to some search criteria, and you can easily edit it. After that, continue to the next page, quit entirely, or do some other unrelated job and finish the report later.

Thirty pages of the instruction manual discuss writing programs to access the data in ENB. I have not studied this or tried to write a program. Any user-Basic program replaces the ENB menu manager and uses the provided ENB Access Method, in machine language, to manipulate the data.

You can use Scripsit or any word processor that reads an ASCII file to access or change ENB data. This is also a faster way to place new data in the data base because it greatly reduces disk access. You place a few simple control codes on each line, with semicolons separating each set's data.

Capacity of this program depends on disk storage and the number of items (objects) in the sets. The distributor says that the program holds 65,280 objects. Each object can be up to 110 bytes (or characters) long.

ENB files can span several drives. Each time you begin using the program, you specify which drive has the most free space. The file grows evenly and gradually on all available drives. A four-drive system could fill disk capacity before reaching the object limit, if most objects were near the 110-byte limit.

Conclusion

ENB is fascinating. I like its efficiency and method of handling data. I also like the double-checked entries and the program's attention to accuracy. The ability to add new sets after you've established the data base is also very useful.

The uncluttered appearance of reports, the sophisticated search functions, and the VisiCalc/Scripsit interfaces are among the many assets of this quality program.

Speed is the program's greatest drawback. I used the program on an LNW that runs at 4 megahertz, twice the speed of a Model III. I found the speed acceptable for important tasks, but unacceptable for mundane jobs. This distinction is important. ENBase is not an all-purpose program; don't try to use it for 2,000 names on a mailing list.

Save it for complex interactive data management, where speed is less important than sophistication. Clock speed-up kits are available for the Models I and III, and might be worth considering if the slow speed bothers you. Since disk access causes much of the waiting time, speed should be no problem with a hard-disk system.

The other major drawback is the difficulty in initializing the program. You might spend weeks trying different approaches. On the other hand, many data bases are unable to handle tasks that ENB does with ease. If you have such a task, the time you spend getting ENB running is insignificant. ■

Continues on p. 60

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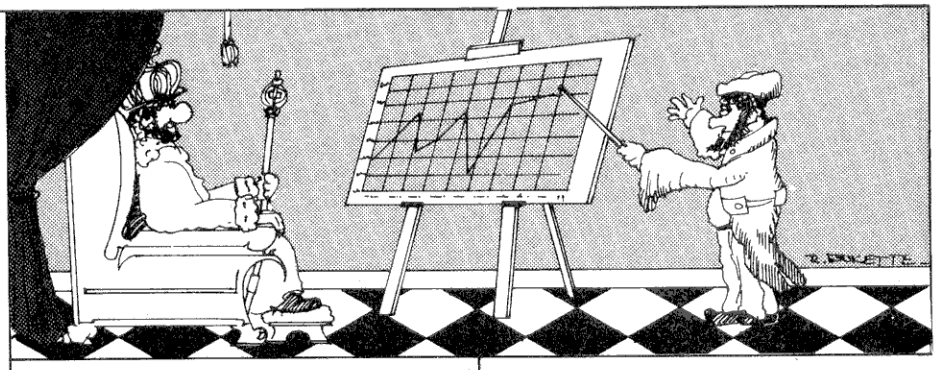

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Several displays (but no graphics) summarize your state of affairs. You start with a beginning-year summary including a weather prediction, the number of personnel, the number of army units, and their efficiency for each country.

A report for each country summarizes government revenue from taxes, the total treasury, and the interest paid on loans from the World Market. It also lists the number of immigrants and emigrants, births and deaths, and the total population.

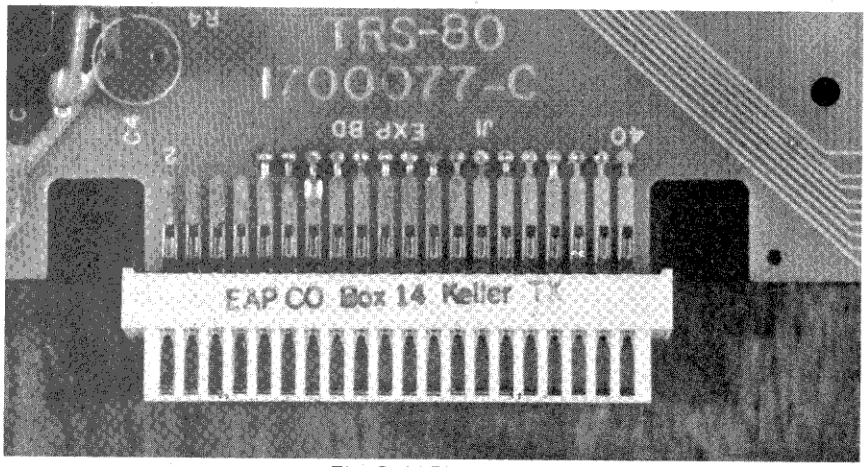
Other displays give you control over and management of your country. Your decisions determine the state of your

$54.95 for COMPLETE SET

Ahhhh, instant relief! At last there is a permanent cure for contact oxidation on Model I edge connectors. Many TRS-80 users are familiar with the symptoms: untimely resets, spontaneous reboots, or the inability to get the computer started at all without a frustrating session with a pink eraser.

The Gold Plug 80 is a well made device consisting of an edge-card plug with gold plated contacts, available with either 34 or 40 contacts. The rear of the plug has terminal tabs which fit exactly over the existing foil fingers on the TRS-80's connectors. After installation, the original plugs have been extended about a half inch, meaning that the plastic door covers no longer fit. This did not trouble me, but you should take it into consideration. E.A.P.'s advertising leaflet, by the way, cautions you about the doors, which is refreshing. They also have the excellent policy of permitting you to return any plugs ordered for a refund if after seeing them you are unwilling to undertake the installation.

An excellent set of instructions accompany the plugs, and they are shipped promptly. I ordered mine by mail on a Monday and received my set of plugs by first class mail on Tuesday of the next week.



The Gold Plug 80

Installation

Installation requires a soldering iron (I use a 40-watt Weller), Rosin-core solder, a Phillips screwdriver, and your last Pink Pearl. The keyboard and Expansion Interface have to be disassembled to get at the connectors, which are then cleaned—the eraser's last fling. The Gold Plug 80 is fitted over the existing plug with the contacts centered, and then soldered to the board. I have some soldering experience, but it proved to be an easy, safe job. The contact is heated, a very small amount of solder applied, and then you go on to the next contact. It took about an hour to do all six plugs.

If you are a little nervous about this kind of work, note that all the contacts on the underside of the RS-232 output connector are grounded—that is, they are all connected. Start there; you can do no harm and the practice will be helpful.

The Gold Plug 80 set I bought included all six plugs. The plugs are available individually for $9.95, or you can get a pair for the keyboard to Expansion Interface cable for $18.95.

As I said earlier, I did resolder every connector on the machine, and I haven't had a single unwanted reset since. ■

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country's economy, the army's condition and size, and whom you attack.

Remaining displays give battle results and a year-end summary. The summary indicates the amount of land, population, GNP, and industrial health of each country. You need this information for next year's decisions.

The game continues for several years, limited only by the skill of the players. It's not uncommon to play for 20 or 30 years or more, depending on the number of players.

The 39-page manual explains the game adequately, but is lacking in some respects. It doesn't explain that the game is for more than one player, although it is suggested by the terms human countries and computer countries.

The most obvious omission is the manual's lack of instructions on loading the disk. The disk is labeled Model I/III, but doesn't boot on a Model III. It does have a Model III boot sector in single density that can't be read. To boot the disk on a Model III, use the convert program from TRSDOS or other operating systems.

If you like intellectual game playing, you'll like Supreme Ruler. It isn't fast-paced, but it requires much thought. The game provides a change from arcade games that rely on reactive skills.

Supreme Ruler is well programmed. The displays are easy to read despite intricate interrelationships and formulas. My major criticism is that mismanagement of your country is not explained, only the end result. Also, the game includes some misspelled words that you can correct easily since Supreme Ruler is programmed in Basic. ■

★★★★
ZSIM
Instant Software Inc.
Peterborough, NH 03458
Model I, 16K
$29.95 cassette

by Carl Oppedahl

ZSIM is a utility for Model I owners who do a lot of Assembly programming. It lets you study, test, and debug machine-code programs with more control and versatility than simpler utilities such as Radio Shack's Debug.

Like Debug, it lets you inspect and modify register and memory contents, and allows you, through breakpoints, to execute selected portions of a machine-language program in RAM. Unlike Debug, it also lets you use breakpoints to run portions of ROM, as well as halt execution of a program being tested under any of a variety of conditions.

From Assembler to Emulator

In the early days of microcomputing, programmers had to assemble and enter machine code (ones and zeroes) by hand. Assemblers, which produce code from more understandable Assembly language, made the process easier, but their programs defied debugging.

The next big step was the development of debugging monitors, which allow carefully controlled execution of machine-language programs. By inserting a breakpoint in the program being debugged, it is possible to execute part of the program, and then return to the monitor.

Radio Shack's Debug program is typical of modern debugging monitors. It resides in memory along with the program being debugged. Most of the time, Debug is being executed—whenever you are inspecting and modifying registers and memory locations, for example. But when you command Debug to run the program being debugged, the only way it can do that is to jump to that program. Then Debug itself, though still in RAM, is no longer being executed.

This is where the breakpoint comes in. If you tell Debug to execute the program starting at 7000 hexadecimal (hex) with a breakpoint at, say, 7010 hex, then Debug does not immediately jump to 7000 hex. First, it replaces the current contents of 7010H with an RST 30 instruction (hex value F7), which returns control to Debug. When execution reaches the breakpoint address, the F7 hex causes the CPU to restart, commencing execution at address 0030H within Level II ROM. The ROM code there is a jump to 400F hex, which is in RAM—and the code there is a jump to Debug again, placed there as part of Debug's initialization routine. At this point, the original contents of the breakpoint address (7010H in this case) are restored.

If you use Debug to watch the breakpoint location, you won't see the F7 hex. Debug's screen display routine shows the original contents at all times.

This lengthy discussion of breakpoints is necessary to allow me to describe the various ways that emulators like ZSIM represent an improvement over traditional debugging monitors.

Enter ZSIM

An emulator is a program that accepts machine language as input and produces a description of what would happen if a CPU were executing the code directly. The fundamental difference between an emulator such as ZSIM and a monitor like Debug is that ZSIM is always running and has nearly complete control over what's going on, while Debug sometimes yields control to the program being tested, regaining it only if a breakpoint instruction is encountered.

From the user's point of view, running ZSIM is much like running Debug. With the program to be tested already in memory, you load and run ZSIM. The utility sets up simulated CPU registers in RAM and commences simulated program execution, instruction by instruction.

For most opcodes, the emulation process takes four steps: The contents of the simulated registers are loaded into the actual CPU registers, the instruction is executed, the contents of the actual registers are loaded into the simulated registers, and the simulated program counter (PC) is incremented.

If the instruction is a jump, the simulated (not the actual) PC is loaded with the jump address. If the instruction is a conditional jump, the condition is evaluated (based on the contents of the simulated registers) and the simulated PC is updated as necessary. Calls and returns are handled similarly.

Execution of the program being tested, then, occurs step by step, with full control before, during, and after the emulation of each instruction. And this is the real power of ZSIM: You can instruct it, ahead of time, to halt execution when it enounters any of a wide range of conditions. For example, ZSIM can stop when a CPU register or register pair reaches a certain value, when a load is attempted outside a certain range of addresses, or when pro-

gram execution is attempted within a certain area. In the emulation equivalent of a breakpoint, execution halts when the simulated PC reaches a given value.

Another potent feature of ZSIM is that it can be used to study and debug ROM routines with the equivalent of a breakpoint. Recall that Debug regains control of a program by placing an F7 hex at the desired stopping point. Since this is impossible to do in ROM, there can never be a return to Debug once the jump to ROM occurs.

ZSIM, on the other hand, produces a breakpoint interruption simply by testing the contents of the simulated PC register after each emulated opcode execution, regardless of whether it comes from RAM or ROM. (The ZSIM instruction for this is a Stop command.)

As with Debug, you can enter commands to inspect and modify (simulated) CPU registers and (actual) memory locations, and can directly execute machine code with breakpoints. (ZSIM uses a Restart 8, hex CF, for the breakpoint return code, rather than Debug's Restart 30.)

The Drawbacks of Emulation

Since emulation provides easier and more fruitful debugging opportunities, why would you ever use actual execution?

First of all, emulation is slower—as much as 10 times slower for one case I tried. For each program step to be emulated, the CPU goes through several dozen ZSIM steps.

This slowness can be more than a mere nuisance. For example, tape and disk operations with the TRS-80 depend on precise execution times to read and write data. For instance, cassette input/output doesn't work properly if CPU interrupts are not disabled through CMD "T." The periodic execution of the interrupt routine distracts the CPU from servicing the tape read/write circuitry. Similarly, a program's test tape and disk I/O operations do not emulate properly. ZSIM's execution-with-breakpoint mode should be used instead.

The keyboard input ROM routine at 002B hex is also prohibitively slow if emulated, so ZSIM is designed to run, rather than emulate, that code whenever it is called. Printer and video output, on the other hand, suffer only slightly when subjected to emulation, so ZSIM makes no special provision for those routines.

Command Vocabulary

Like Debug, ZSIM offers ASCII and hex display modes, display and modification of specified memory locations and Z80 register contents, and single-step execution with and without calls executed in full.

In addition, ZSIM the program being tested with continuous listing (and option printing) of an abbreviated or detailed trace, showing register contents, disassembled opcode of each instruction, and other information. If one or several register-test conditions are selected and program execution stops, ZSIM lists the reasons in the Trace display. (A sample detailed trace is shown in Fig. 1.)

In addition, the AREA command suppresses the trace display at all times, except when the simulated PC value is within a user-specified area.

The PRNT command routes all screen output to the printer, which is very handy during troubleshooting. Almost every ZSIM command causes the screen to be completely "repainted," so if the PRNT mode has been selected, the entire screen resulting from each command is printed. One potentially bewildering side effect is that, if the printer is accidentally left off line, ZSIM appears to hang up when the next command is typed.

The DISA command produces a disassembled listing of 15 instructions starting at a selected address (see Fig. 2). According to the manual, if the Radio Shack Editor/Assembler was used to assemble the program under test, DISA (and certain other commands) will use the symbol table to yield a fully symbolic listing. I could not, however, get that feature to work with my Disk Editor/Assembler (#26-2202). Elsewhere in the manual I found mention of Tandy's Tape Editor/Assembler (#26-2002), Macrobiotic Computing's DOS disk editor/assembler, and Instant Software's ASSEM, so perhaps the symbolic feature of the disassembler works only with these utilities.

Another disappointment with the DISA command is that it does not list the hex code along with the Assembly-language opcodes. Finally, it would be nice if typing "DISA" would list the next 15 opcodes after the ones just disassembled. Instead, you must figure out whether the last opcode listed was a 1-, 2-, or 3-byte code, and add 1, 2, or 3 to the last address to disassemble the next few instructions.

There are a few other features that would have made the command set more user-friendly. For example, the M

```
DISA 7000
7000  LD HL,4650     0000   +4650
7003  LD DE,7650     0000   +7650
7006  LD BC,1A00     0000   +1A00
7009  LDIR           0000   +7009
700B  NOP            0000   +700B
700C  NOP            0000   +700C
700D  NOP            0000   +700D
700E  NOP            0000   +700E
700F  NOP            0000   +700F
7010  NOP            0000   +7010
7011  NOP            0000   +7011
7012  NOP            0000   +7012
7013  NOP            0000   +7013
7014  NOP            0000   +7014
7015  NOP            0000   +7015
```

Fig. 2. Disassembled Memory Contents

```
DUMP 7000
7016 NOP                    A=FA S-X-X---  BC=0000  DE=9050  HL=6050
          0000+1570                        IX=0000  IY=0000  SP=42E5
AF'=0000          BC'=0000    DE'=0000          HL'=0000
BC =0000          F3 AF C3 74 06 C3 00 40       C3 00 40 E1 E9 C3 9F 06
DE =9050          00 00 00 00 00 00 00 00       00 00 00 00 00 00 00 00
HL =6050          00 00 00 00 00 00 00 00       00 00 00 00 00 00 00 00
IX =0000          F3 AF C3 74 06 C3 00 40       C3 00 40 E1 E9 C3 9F 06
IY =0000          F3 AF C3 74 06 C3 00 40       C3 00 40 E1 E9 C3 9F 06
SP =42E5          C7 46 00 00 00 00 00 00       00 00 00 00 00 00 00 00
PC =7016          00 00 00 00 00 00 00 00       00 00 00 00 00 00 00 00
     7000         21 50 46 11 50 76 01 00       1A ED B0 00 00 00 00 00
     7010         00 00 00 00 00 00 00 00       00 00 00 00 00 00 00 00
     7020         00 FF FF FF FF FF FF FF       FF FF FF FF FF FF FF FF
     7030         FF FF FF FF FF FF FF FF       FF FF FF FF FF FF FF FF
```

Fig. 1. ZSIM Single-Instruction Trace

command, used to modify a memory location, requires you to type the letter M, a space, a full four-digit hex address, another space, and the two-digit byte to be stored there, for each location to be modified. This gets quite tedious when 10 or 15 opcodes must be typed in. It would have been better if ZSIM's M command were modeled after Debug's, requiring you to type only the first address and the remaining data bytes one after the other.

Finally, the register modification command does not allow the AF, BC, DE, HL, A'F', B'C', D'E', or H'L' registers to be set as a pair. Instead, the registers of each such pair may only be set individually.

Documentation, Media, And Model III Use

Some programs have a good reference manual (containing a complete enumeration of commands, syntax, and possible error codes) but an inadequate training manual; others have good instructions but lack reference documentation. The 28-page booklet packed with ZSIM avoids both pitfalls, and serves both needs admirably. For someone familiar with an assembler and with Debug, one careful reading and an hour or so of experimentation at the keyboard will help you master the utility.

There is one small inconsistency. It states in the first chapter that ZSIM is slightly more than 650 bytes in length, while a figure shows ZSIM extending from 4650 hex to 5FB4 hex, or about 6,500 bytes. The latter figure is correct.

ZSIM is sold on a copy-protected cassette. It takes almost four minutes to load, which will annoy disk owners, but neither TRSDOS 2.3's Tapedisk nor 2.7DD's Tape can produce a disk copy. According to ISI, the ASSEM and ZSIM programs can be purchased together on disk for $119.97, and an object code printout is available for those who prefer to enter and store the program manually.

Many computer products require elaborate customer support, such as a toll-free phone number and publication of patches. For the most part, inexpensive utilities like ZSIM are purchased only by relatively sophisticated users who can get along with a mailing address and a thorough instruction and reference manual. This is fortunate, because when I called Instant Software, ready to ask some made-up questions, no one could be found to answer them. A woman took my phone number, saying a technician would call the next day, but I received no call.

As a final aside, ZSIM appears to run perfectly on the Model III, although no mention of this is made on the box or in the instructions. It loads from a Model I-format tape, so the slower 500-baud mode of the Model III must be used.

At $29.95, ZSIM is a worthwhile addition to the library of anyone who has mastered Debug, and who writes or studies Assembly-level programs. It is thoroughly error-trapped, fully documented, and does what it claims to do. ■

★★★★

Propack
The Small Computer Company
230 West 41st St., Suite 1200
New York, NY 10036
Model III
$75

by Wynne Keller

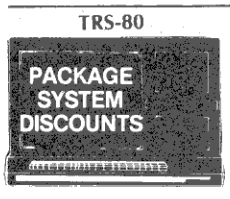
Anyone who uses a data base extensively has probably encountered dead ends. These multi-purpose programs cannot do everything. Problems typically arise when you post monthly balances, or when reports must conform to some printed form. To accomplish these and other tasks, you have to write a program to access the data-base files, manipulate the data, and put it back again. Enter the professional programmer at $25 an hour.

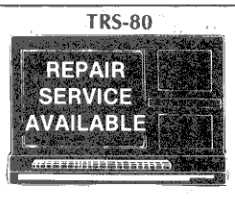
But owners of Profile III+ have another way. With a moderate grasp of Basic programming, you can use Propack software to access and manipulate your Profile III+ files.

You need not know anything about random access file-handling techniques. You just have to know enough Basic to print a report or whatever you intend to do with the file. My own Basic experience could be described as "rusty average," but I have no difficulty understanding the Propack manual.

Propack loads into protected high

Continues on p. 68





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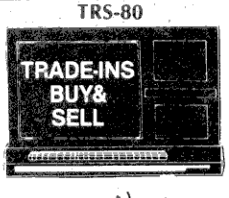

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Address_____

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LOAD 80 and COLOR LOAD 80 are manufactured by Instant Software Inc., a subsidiary of Wayne Green Inc. There is no warranty expressed or implied that LOAD 80 and COLOR LOAD 80 will do anything other than save you typing.

Continued from p. 64

memory, and you access it via the USR command. You dimension an array for the number of fields to be accessed, and declare the file to be read. After the file is opened, you may get the records by indexed sort or by record number.

"I recommend (Propack) for Profile III + owners who know Basic. . ."

In all, Propack has eight commands. GETN increments automatically and brings in the next record. GETX searches the index for a specified record. PUT and PUTN return the records after you're done with them. You must close the files. Both the OPEN and CLOSE statements are Propack commands, and it is not possible to close a file opened by Propack with the Basic CLOSE.

The 36-page hardcover manual is exceptionally clear. Examples are given for all the commands, and a few more advanced Basic words such as CVI are also explained. Possible error messages and their causes are listed for each command.

The Propack package includes some extras. Profile users are familiar with the double-break feature used to exit any program section. After pressing break once, you must do it again to confirm your intention to quit. This feature may be incorporated in any Basic program by using Propack.

Two pages of the manual are devoted to some helpful user-defined functions. These include a function to strip trailing blanks from a string, and a way to ensure that the Basic STR$ command doesn't strip zeros from monetary figures, as in 12.5 when you mean 12.50. The software authors also discovered the Basic VAL function does not work in a Model III when negative numbers are involved. They provide a function to substitute for VAL.

Propack is an excellent utility and I recommend it for Profile III + owners who know Basic and need auxiliary programming to get the most out of their data base. ■

★ ★ ★

Hamburger Sam, Killer Gorilla, Jungle Boy, Hoppy, Penguin
Displayed Video
111 Marshall St.
Litchfield, MI 49252
Model I and III
Each $15.95 cassette
$19.95 disk

by Eric Grevstad
***80 Micro* staff**

Most game companies, hoping for a product review, send *80 Micro* sample copies. Displayed Video makes other firms look like pikers: They sent their entire line of Dubois & McNamara games, five recent creations and seven old ones, crammed onto one double-sided disk. Except for a stick-on label that keeps coming off in the drive, it's one of the most popular disks in the office.

Basically, Dubois & McNamara adapt arcade games for the TRS-80 and assume you know the original coin-op versions. (I can't criticize their documentation since the 12-game demo disk included none. Their ads, long on pictures and short on text, are in the "unnamed, but familiar, game now available for TRS-80" tradition.)

The older games are pleasant but unremarkable. Insect Frenzy, for instance, is a counterfeit Centipede. Ghost Hunter is a fast and somewhat confusing Pac-Man, Alien Cresta sort of a low-rent Demon Seed.

Jungle Raiders keeps you busy defending a camp besieged on all sides by swarms of thieves. Space Shootout is a two-player duel, with contestants blasting away at intervening obstacles so they can blast at one another.

The new games will bring cries of recognition—hazy recognition, given the state of Model III graphics—from arcade fans. Hamburger Sam sends players scurrying around a Panik-type maze of cheese, patties, and buns to assemble burgers, while dodging or peppering nasty hot dogs, pickles, and fried eggs.

Those addicted to the arcade model, Burger Time, will be disappointed at the barely recognizable images but happy to have a home version. Others will find the game slow, complex, and uninteresting.

The leisurely pace continues in Killer Gorilla. Compared to another Model I/III Donkey Kong clone, Computer Shack's Liberator, Killer Gorilla is slow and rather easy (although it gives no points for jumping over barrels or obstacles, and some sputtering bombs liven up the later screens).

While not built for speed, the game has some wit. The title display vibrates to the gorilla's mighty footsteps, and "Help!" flashes beside the various damsels in distress. Rescue one and a Valentine heart appears while the ape stamps off in anger.

This approach is slightly sexist—while Liberator casts you as a "scientist" rescuing an "assistant," here you're definitely a hero saving a girlfriend. (The woman appears to be naked in Displayed Video's ad. Thank heaven for low-resolution graphics.)

The other three new games, while flawed, are more enjoyable. One is Jungle Boy; no one at *80 Micro* could

play it but it made everyone laugh.

After swinging from vine to vine through the woods (see the Atari VCS smash Pitfall), J.B. has to swim a river, surfacing for air à la Sea Dragon and using last-second knife thrusts to kill crocodiles. After that, there's an uphill run through an avalanche, and a dangerous interview with some cannibals.

Considering its adventurous premise, Jungle Boy is ploddingly slow. Timid players can literally wait for minutes before two vines come close enough for the trapeze leap; the staff did Tarzan yells and swan dives all day, usually missing the vine but enjoying the hero's graceful, arching fall to disaster. It's a frustrating game—expect zero scores for some time—but, with practice and patience, it becomes silly fun.

Frogger fans will like Hoppy, which except for the truly horrible screen flicker is an almost first-rate version of the arcade hit. Players spring nimbly between lanes of traffic (cars, trucks, bulldozers) to reach an equally treacherous stream, crossed by means of floating logs and temporarily floating turtles. Flies (1,000 points) and alligators (instant death) pop in and out of the harbors on the far side of the stream.

Catching the end of a log or jumping to a safe harbor requires extreme precision, which is tricky since the arrow keys are sensitive to the point of keybounce. Crossing the highway, the frog can easily die by overtaking cars from behind. Nevertheless, Hoppy is probably as good a jump as the Model III will see.

Probably the most successful arcade adaptation is Penguin, an amiably lowres version of Pengo. The hero moves with a nice waddling motion (particularly on the diagonal), scuttling around a floe littered with ice cubes and icicle monsters.

Once you're alongside a cube, a spacebar kick sends it sliding across the ice, obliterating monsters in its path. The monsters destroy stationary cubes, eating your ammunition in their quest to eat you. A time limit (dwindling energy level) keeps the pressure on. After clearing one floe, another appears with a different arrangement of cubes and more monsters.

The Displayed Video games aren't TRS-80 classics: The graphics are average, the sounds are mostly perfunctory beeps and buzzes, and the action rarely surpasses a walking pace. Still, they're priced $5 to $10 apiece under the competition. At that price, they're worth considering as pleasant diversions.

Not a rave review, but the 12-game disk spoiled us. If they could sell that disk for $75 or $100, Displayed Video might well dominate the industry. ■

★ ★ ★

The Last One
D.J. 'AI' Systems Ltd.
2 Century Plaza #480
2049 Century Park East
Los Angeles, CA 90067
Model II
$495

by Charles R. Perelman

The Last One is a program generator that lets you produce ready-to-run (under TRSDOS) Basic programs by answering menu prompts and questions in plain, though structured, English. While familiarity with Basic is not a necessity, it's certainly helpful. The Last One has its place for neophyte programmers, but it's neither a panacea nor the last program you'll ever need to buy (despite its name).

The Last One requires that you meticulously plan your program in advance, drawing up a detailed outline of program logic and screen displays. The penalty for sins of planning omission is redoing major portions of the creative process. For example, all files are random-access and therefore have to be named. It's impossible to access or store data in a file not named during program design.

An early prompt asks you to put your printer on-line. Turning it on at that point is essential. (After the program burps the printer with a line feed, you can shut it off until the flowchart is completed.)

Generating a program involves naming your files and establishing the length, name, and character of file variables (alphanumeric, numbers only, or date). The program automatically error-checks entered data.

Listing of NEWSEC4

```
1    . . Branch on a 5 option menu to 2, 7, 14, 21, 47
2    . . Set pointer to the end of SECS file
3    . . Keyboard input for SECS file
4    . . Write data to SECS file
5    . . Ask <MORE DATA TO ENTER?>. Branch if yes to 3
6    . . Direct unconditional branch to 1
7    . . Set pointer to the start of SECS file
8    . . Keyboard search of SECS file <ON EOF to 45>
9    . . Check records from SECS file
10   . . Backstep within SECS file
```

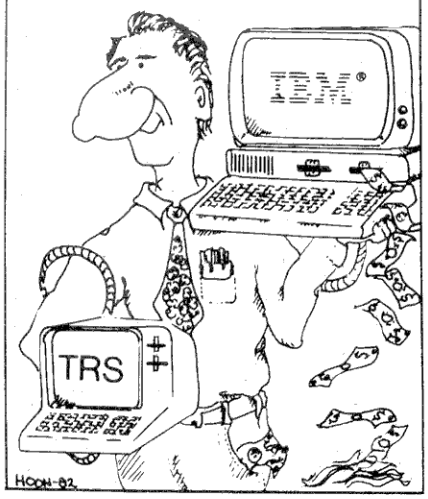
Figure 1

```
Line 3 . . . KEYBOARD INPUT
Draw settings . . .
Insert Text of "ADD A SECURITY TO LIST" at 30,2 underlined with "="
Insert Text of "TYPE IN INFORMATION AS INDICATED FOR NEW SECURITY" at 10,15
Row/Column settings . . .
QUANTITY          8   5   8   20
DESCRIPTION       9   5   9   20
PURCHASE DATE     10  5   10  20
COST              11  5   11  20
With Tidy screen
A clear screen before KEYBOARD INPUT
With correction facility
```

Figure 2

Architects' Options

The next step in program construc-



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tion is to describe the program in a stylized flowchart of words (rather than graphics) using a 19-item menu. Fundamental building blocks include file, screen, or printer output; keyboard or file input; search; sort; and branching. You can branch to another part of the program unconditionally or only when a logical condition, such as a match or a yes-or-no answer, is satisfied.

The Merge Fields function puts an entry in the specified field of each record in a file. For example, you may want to key all records identically at program initialization.

The Last One's binary search algorithm is reasonably fast. It matches portions of a key field, continuing on with other items that match the search parameters, or lets you review all items in a file by using null as the matching key. You can sort up to three keys simultaneously. Either ascending or descending order is available; subgroups are properly ordered when multiple keys are used.

"One of The Last One's strongest points is its display-design routine. . . . centering, underlining, and normal and reverse-video lines and boxes are all menu choices."

Special functions let you insert pauses, generate random numbers, and, most important, run other programs. Since variables are not saved automatically, you must place them in a file before leaving the main program to access subprograms.

File-pointer manipulation enables you to examine records, modify data, clear files, and organize indexed file structures.

The Calculations feature lets you use arithmetic, trigonometric, and other Basic operators, enter code in Basic, and use subroutines within complicated formulas. Most formulas are entered in straightforward algebraic notation. While in calculate mode, Control F calls a help screen listing the variables The Last One assigns to all fields and file pointers. Unfortunately, you cannot calculate with field labels, but must use the assigned letter-number combinations and letter variables that don't conflict with those already defined.

To use effective Basic inserts with Calculations requires Basic programming knowledge, careful analysis, and some experimentation. It takes practice to work with the available functions.

After you complete the flowchart of program steps, map out the program path by inserting the applicable destination for each branching decision in your list—and turn on the printer, lest all coding after the flowchart be deleted when the program is generated. With the printer safely on-line, The Last One prints and digests your flowchart, and the fun starts. (Figure 1 is an example of a partial flowchart for a simple sort-and-list routine for securities.)

From Flowchart to Program

Flowcharts from separate modules or small programs can be merged with a menu option. Branching destinations and coding after completion of the combined flowchart must be reentered.

Each line of the flowchart is processed, and you are asked questions at any point where instructions to the user, decisions, or display of data may be appropriate. The program lets you review all entries before final coding (see Fig. 2 for an example of the printout of a user-specified flowchart line).

One of The Last One's strongest points is its display-design routine. Full-screen editing is not provided, but centering, underlining, and normal and reverse-video lines and boxes are all menu choices.

Other display options include a report format in columns with headers, page numbers, and footers, directed to either screen or printer, and the choice of displaying individual fields rather than an entire record. These options make creating effective screens easy.

The software gives you several opportunities to make corrections before setting program parameters. As for the finished program, you can design your own error-trapping routines or accept

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the ones automatically included. Built-in routines ignore improper data input, but no error message is given to the operator.

With its questions answered, The Last One takes your specifications and writes the Basic program in ASCII format. Load Basic and the new program, then save it in TRSDOS compressed file mode, and it's on disk and ready to run. Generated programs are completely functional, and screen displays look good.

Different portions of a generated program are shown in the Program Listing. The first two segments show part of the housekeeping code, a series of subroutines for screen and data management and error-checking. The last lines are applications-specific, file-handling routines.

Although most input, output, and error-checking functions use subroutines, file access coding is repetitive and increases the program's size. Note the logical operators to compact the Basic code. The "tight" code makes deciphering the program rather difficult, particularly since there are no comments.

Despite The Last One's sophisticated use of string operators, the manual only identifies file variables and pointers, rather than explaining variables that are used in generated programs. This makes modifying or patching programs a chore.

In constructing a complex program, you'll save hours of time and avoid frustration by starting with a shell program of proven routines and calling your enhancements from subprograms. This limits recoding modifications to the called programs, which can be appended to the main section after debugging.

Veddy, Veddy British

Printed in England, where the program originated, The Last One's manual is attractive, readable, and well organized. Its chapters are arranged in the same sequence as the program's menus and prompts. I would have liked additional information and routines for using the various functions, since the software is more powerful than a first reading indicates.

The index is also skimpy, considering the program's complexity and the amount of detailed information presented; it should be expanded substantially. More helpful documentation includes tear-out cardboard sheets with copies of most of the menus, a glossary, and grid sheets for screen design.

Section 3 of the manual is a fairly comprehensive introductory tutorial. Information for program initialization appears only in this section, making it mandatory reading before diving into The Last One. The rest of the section contains detailed instructions for writing a mailing and phone-list program. The tutorial is well-written, understandable, and indispensable for understanding the creative process. As the table of contents says, "If you intend to load and use The Last One without reading the manual first, then for heaven's sake start here."

Some other droll humor shows up, along with British spellings. The manual's copyright information remarks, "Finally, our Legal Eagles have come up with the following piece of dynamic gibberish which says, in summary, that if you write a program . . . which causes your computer to disintegrate into a pale pink mushroom cloud, then it's your fault." The menu choice for ending a program is "Go home for tea."

A flowchart and coding printout, called "trace documentation," describe an invoice-generating program and a mailing list and label printer. This information teaches you combinations of flowchart lines that invoke program features and demonstrate some Basic insertions. D.J. 'AI' Systems states that they send customers other sample programs on request.

Experienced Basic programmers should find the documentation adequate after some experimentation. Beginners will have difficulty setting pointers or taking advantage of features like Basic patches and calling related programs; they may be able to do little more than imitate the tutorial and sample programs.

D.J. 'AI' System's Los Angeles office appeared anxious to please, offering to review any documentation created by a registered purchaser to help solve programming problems. Software updates are currently free.

Permanent Records

From the description of the functional tools used as building blocks, you can see that The Last One is oriented toward, and reasonably well-suited for,

```
10 REM -NEWSEC4 Written by THE LAST ONE
20 CLEAR 5000:ON ERROR GOTO 55000:DEFDBL A,N:DIM A$(4),B$(4),S$(4)
,W$(4):GOTO 50000
30 PRINT@(V-1,H+(H>0)),CHR$(2);:RETURN
40 OK=1:IF MD=0 GOTO 60
50 MD=2:PRINTCHR$(28)">";:K=ASC(INPUT$(1)):PRINTCHR$(28)" ";:IF K=
13 THEN OK=0:RETURN:ELSE IF K<>32 GOTO 50
60 DL=VAL(LEFT$(A$,1)):ML=VAL(MID$(A$,2))-DL+(DL>0):IF ASC(A$)<65
GOTO 110:ELSE ON ASC(A$)-65 GOTO 70,250,250:DL=99:GOTO 110
```

Initial Lines

```
290 D$=MID$(A$,4,2):M=INT(VAL(A$))
300 D=VAL(RIGHT$(A$,2))/4:D=-(D=INT(D)):IF D$="00" OR M=0 OR M>12
THEN D$="":GOTO 280
310 IF D$>MID$(" 312831303130313130313031",2*M,2) THEN IF NOT (M=2
 AND D>0 AND D$="29")THEN D$="":GOTO 280
```

Use of String Operators in Routine to Check Date Entry

```
520 RESTORE 540:F!=0:FOR I=1 TO 4:READ L!:IF I=1 THEN FIELD 1,L! A
S W$(I) ELSE FIELD 1,F! AS F$,L! AS W$(I)
530 F!=F!+L!:NEXT:FIELD 1,6 AS LR$
540 DATA 10,25,8,11
550 LSET W$(1)=A$(1)+CHR$(5):LSET W$(2)=A$(2)+CHR$(5):LSET W$(3)=A
$(3)+CHR$(5):M=11:D=2:A=VAL(A$(4)):GOSUB 360:IF ASC(A$)=37 THEN ER
ROR 77:ELSE LSET W$(4)=MID$(STR$(VAL(A$)),2+(VAL(A$)<0))+CHR$(5)
560 PUT 1,PA+1:PA=PA+1:IF PA>EA THEN EA=PA-1:GET 1,1:LSET LR$=MID$
(STR$(EA),2):PUT 1,1
```

File Handling Routine

Program Listing

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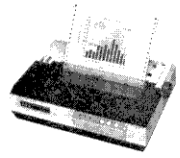

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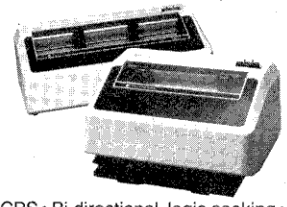

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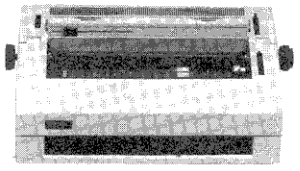

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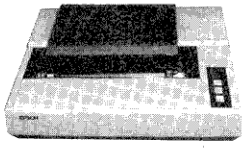

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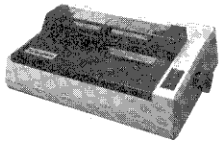

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data base or sorted list programs. However, there is no delete-a-record function.

Using random files, if you mark items with a delete key, sooner or later you must have a routine to compact the file. I used the Calculations feature to insert Basic patches to delete records; unless you know something about Basic, you're out of luck on this score.

Either a delete function should be added or a delete routine included in the documentation. The Last One's convoluted code for opening, closing, and fielding files makes tracing the flow to locate patches tedious. The lack of a record deletion feature contradicts the concept of program generators.

A further complication, copying data from one file to another, involves more than a read followed by a write. Since The Last One assigns unique variables to each file, you need a formula to equate them: for example, B$(1) = A$(1). In this way, the variable for the second file (B$) is initialized to the value of its counterpart in the first file. You won't find this information in the manual. I gleaned it from a careful review of a generated program that didn't work as expected.

Fascinating, Not Fast

What The Last One does is fascinating, and the code it produces is interesting and educational. Its two most glaring problems are slow speed and complex debugging. Except for the machine-language break-disable routine, the program consists of a number of Basic overlays.

Because it extensively accesses random files, collects garbage as Basic clears string space, and frequently rewrites screens, creating a program with The Last One is slower than molasses in January. Keyboarding is often interrupted, apparently for string reorganization; touch typists will be aggravated to find characters in the middle of a word failing to register, or the screen display coming to a halt. Perhaps operating with a hard disk is more satisfying.

When running the finished program, disk accesses for sorting and listing as few as a dozen records with four or five fields cause a blank screen for several seconds. According to the manual, the shell sort used in generated Basic programs could require 20 minutes or more for files of 500 records. This is not entirely the fault of The Last One, since the intention is to stick to Basic rather than machine language, but it does affect program performance. For faster operation, the manual suggests restructuring your program to obtain information with a search instead of a sort.

The software's most significant drawback becomes evident when you make an error or want to modify a program. You can modify the original flowchart by inserting, deleting, or swapping lines, then reentering all branching instructions. As I discovered through trial and error—these details are not mentioned in the manual—a new line at the end of a flowchart is not inserted, but simply entered and automatically appended. To modify a line, first delete it and then insert a new one.

"... The Last One's built-in functions provide an excellent programming shell."

Earlier, I emphasized turning on your printer when you start, and suggested building program additions as external routines prior to debugging. This is because there is no way to change a small part of the coding after completing the flowchart.

Program generation destroys all coding subsequent to the flowchart; the question-and-answer session must be completely redone, without benefit of any prior information unless you printed the documentation on the first run. It's like using a compiler, but having to redo much of the coding before recompilation.

The manufacturer claims jumping to a specific coding location to make corrections is prohibited due to hardware limitations related to file handling. The IBM PC version is supposed to allow corrections without complete recoding.

Operating Comments

You need two disk drives for The Last One since flowcharts and programs are placed on separate disks. A menu-driven library feature lists and displays information from prior programs on all work disks; previously designed files or flowcharts are quickly integrated into new routines. Unfortunately, there is no facility to delete stale or erroneous data from the work disk or library index.

The manual suggests you use The Last One only for programs that would require over 15 minutes to code in Basic. Without any changes, I found that even comparatively simple programs with files require closer to two hours. A shell for a formula can be written in 30 minutes to an hour. That's not too bad for a complete program, but it assumes no errors or modifications. You don't have the flexibility of an interactive interpreter.

Educationally speaking, studying the generated code yields valuable lessons in creating screen displays, handling data with random files, and trapping errors. You will probably get some ideas of how to use logical and string operators to condense Basic programs at the cost of added complexity.

Wrap-Up

The Last One is an impressive piece of software. It is one of a number of program generators on the market that herald a trend toward easier programming. As memory greater than 64K becomes standard, software like this will emulate minicomputer and mainframe capabilities, giving a wider range of program versatility.

The sample trace documentation demonstrates that complex programs can be written with considerably less coding than starting from scratch in Basic. D.J. 'AI' Systems offers documentation for several programs without charge; users knowledgeable in Basic subroutines have almost unlimited flexibility in customizing calls for specific programs with the Calculations feature.

If you can survive the slow pace of creating a program and the cumbersome, often frustrating, procedure for recoding the entire question section for modifications, The Last One's built-in functions provide an excellent programming shell. If you want a quick method of designing screen displays, need a number of routines involving a lot of data entry followed by searching for specific records, or can use Calculations to speed complex formula manipulation, The Last One may be just your cup of (English) tea. ■

REVIEW DIGEST

Versaledger II, H & E Computronics, 50 N. Pascack Road, Spring Valley, NY 10977; Model II/12, 64K, $149.95.

"Going back three years to the time when I was putting my books on my first computer, I would have been happy if I had Versaledger II. It does the job it is supposed to do. . . . I can think of no information you must have from your general ledger not provided with Versaledger II." *two/sixteen*, March/April, p. 35.

Stat Multi-Pack, Robert R. Belanger, 541 W. 6th St., Azusa, CA 94702; Model II/12/16, $325.

"Stat Multi-Pack is a very good package of advanced statistical routines that will appeal especially to researchers in psychology and education. . . . It does have advanced capabilities that are hard to come by this side of mainframe packages like SPSS, SAS, and BMD. Stat Multi-Pack is aimed at serious researchers who understand the sophisticated results they can obtain easily with this well-crafted package. It is the best package available for the Model II/ 12/16 running either TRSDOS or CP/M." *two/sixteen*, March/April, p. 48.

Synther-7, Computerware, Box 668, Encinitas, CA 92024; Color Computer, $21.95 cassette, $26.96 disk.

"Synther-7 is a real-time music synthesizer which is totally controlled by software. It enables you to generate musical notes and sound effects from designated keys on the computer. These sounds can be modified by several parameters before they wind up on your tv's audio speaker or cassette's audio input. Because the sound is routed to the AUX jack, it enables you to record your works right onto the cassette recorder, or for that matter, any recording device at all. . . . Overall it is an excellent program and well worth the list price." *the Rainbow*, April, p. 156.

Super Color Disk Zap, Nelson Software, 9072 Lyndale Ave., S. Minneapolis, MN 55420; Color Computer, $49.95 disk.

"Super Color Disk Zap is a machine-language disk utility program that has many useful features. . . . If you are at all serious about your disk system, this program is a must. Mr. Tim Nelson, the author, is to be congratulated on a job well done." *the Rainbow*, April, p. 139.

Computers In The Schools, Ronald G. Ragsdale, OISE Press (Ontario Institute for Studies in Education), 107 pp.

"Ragsdale asks the all important question: 'Why should schools use computers?' and goes beyond the facile 'wave of the future,' 'keep up with the Jones' positions to discuss real and rational issues.

"The book is not a guide to specific makes—there are plenty of books that purport to tout virtues—but it is a thorough exposition of problems, pitfalls, power, perquisites and advantages to be gained from computer use in a variety of educational roles." *InfoAge*, March, p. 39.

Mastering VisiCalc, Douglas Hergert, Sybex Inc.; 217 pp., $11.95.

". . . *Mastering VisiCalc* is intended for beginners. The author takes the reader through a brief, lucid, and surprisingly comprehensive tour of VisiCalc's capabilities, with special emphasis on home, office, and scientific applications. He then goes through a hands-on instructional that quickly gets the user into the program and establishes a rapport between novice and spreadsheet.

"But even people who have worked with VisiCalc can derive considerable benefit from *Mastering VisiCalc*." *Personal Computing*, May, p. 142.

Breakthru, Avalon Hill, 4517 Harford Road, Baltimore, MD 21214; Color Computer, $20.

"This is truly a good game. Don't expect Britt Monk's version to be yet another version of the game Break Out, it's better. . . . Breakthru simulates three-dimensional play without wearing the funny glasses. It's an enjoyable, fast, and fun game." *The Color Computer Magazine*, May, p. 73.

The Beginner's Guide to Computers, Robin Bradbeer, Peter De Bono, Peter Laurie, Addison-Wesley, Reading, MA; 208 pp., softcover $9.95, hardcover $19.95.

". . . (this) is an exciting book that covers a lot of ground. While it's a great introduction to computers. . . this is not the book to get if you want specific information on which microcomputer to buy. . . a fine general introduction whose only major weakness (is) a difficult section on programming." *Popular Computing*, June, p. 214.

TAS Utility Package, The Alternate Source, 704 North Pennsylvania Ave., Lansing, MI 48906; Model I and III, LDOS, one disk drive, $49.95.

"This package consists of four separate utilities for TRS-80 computers using the LDOS operating system. . . . These are functional and useful programs. . . . At less than $50, they represent an excellent value, and even using just one of the utilities regularly will justify the purchase price of the package." *InfoWorld*, May 2, p. 61.

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13–15 American Production and Inventory Control Society, Falls Church, VA. **APICS 1983 Summer Seminar** Doubletree Plaza Hotel, Seattle, WA.

14–17 **Origins '83 International Adventure Gaming Convention** Cobo Hall, Detroit, MI.

18–19 Hewlett-Packard, Palo Alto, CA. **Productivity '83** Westin Hotel, Seattle, WA.

20–22 University of Oregon, Eugene, OR. **Computers in Education Conference** Hilton Hotel and Convention Center, Eugene, OR.

25–28 IEEE Computer Society, Silver Spring, MD. **Softfair Software Development Conference** Hyatt Regency, Crystal City, Arlington, VA.

26–29 University of Illinois at Urbana-Champaign, Urbana, IL. **Computer-Based Music Instruction Workshop** UIUC campus.

August

2–4 **Microprocessor Background for Management Personnel** University of California Extension, Berkeley, CA.

22–26 American Association for Artificial Intelligence, Menlo Park, CA. **National Conference on Artificial Intelligence** Hilton Hotel, Washington, DC.

September

26–29 IEEE Computer Society, Silver Spring, MD. **Compcon Fall '83** Marriott Crystal Gateway, Arlington, VA.

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Coming Next Month

"Aaargh!" yelled Mad Max. "Level 4's impossible!"

"Sounds like Madison, WI's been destroyed by meteors again," Mercedes said. Max was playing Tom Alar's Armageddon, one of the programs we've been reviewing for *80 Micro*'s annual games issue. Normally, the Gamer's Cafe relies on commercial software, but the August articles have kept us typing programs and giggling a lot.

Besides Armageddon, Max endorses Hollie Satterfield's Attack of the TRS-80, an adventure that challenges you to destroy a crazed Model I, and Mike Conforti's Muddy Pig Simulator ("Slippery swine!" Max snarls every time one gets away). Max's two favorite movies after *Tron* are *Animal House* and *The Paper Chase*; there's a campus adventure that combines the two.

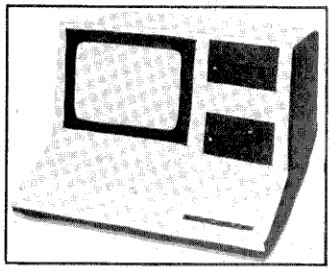
Mercedes Silver read the more serious articles ("You're not going to let them print Strip Blackjack, are you?"), and recommends August's do-it-yourself joystick and CoCo game design tutorials. Her favorite is Joseph Dlhopolsky's machine-language patch that uses the CRT's electron beam to eliminate screen flicker, but she admits to liking Maxwell's Demon ("It's a game, but it's based on a scientific theory"). I caught her puzzling over an Australian adventure, Lost on the Great Barrier Reef, too.

There are Color Computer and I/III games ranging from Kings and Castles and Crypto-Mania to Maze Chase and Micro Melodies. There's even an adventure, ten casino games, and a buyer's guide to more games for the Model II/12/16.

"And a patch to slow down Level 4 of Armageddon," Max said. "Please?"

—Rodney Gambicus

Look Again



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See List of Advertisers on Page 355

La Plume de Ma Tante

by Philip Martel and Robert Nicholas

If you've ever wondered why there are so many programming languages for the TRS-80, this overview provides insight and program examples.

Language	Model I and III	Color Computer
Basic	Yes	Yes
Assembly	Yes	Yes
Fortran	Yes	No
Cobol	Yes	No
Pascal	Yes	Yes
APL	Yes	No
Forth	Yes	Yes
Logo	No	Yes
Lisp	Yes	No
Pilot	Yes	Yes

Table 1. Languages for Radio Shack Computer Systems

Language	Version
Basic	Radio Shack Basic
Assembly	Disk-based NEWDOS+ version of Radio Shack's Editor/Assembler
Fortran	Microsoft's Fortran
Cobol	Ryan-McFarland Corporation Cobol package
Pascal	Pascal-80 by Phelps Gates
APL	APL-80 by Phelps Gates
Forth	Model I Forth by Miller Microcomputer Services
Logo	Radio Shack Color Logo
Lisp	Lisp and program by Randy Beer (*80 Micro*, March 1983, p. 176, April 1983, p. 254)

Table 2. Language Versions Used for Program Listings

"My aunt's pen." If you've taken first year French, you know the phrase. It's one of the many senseless phrases one learns in mastering a new language.

According to *Webster's New Twentieth Century Dictionary*, a language is "any means of expressing or communicating, as gestures, signs, animal sounds, etc. All the vocal sounds, words, and the ways of combining them common to a particular nation, tribe, or other group."

The *Encyclopaedia Britannica* (15th edition) defines computer languages as "sets of characters used to form symbols and words in such a manner that the various steps of solving a problem may be communicated to a computer."

The concept common to these two definitions is that language produces communication using a set of words and symbols. Communication is the key.

You communicate with computers for many reasons: to balance your checkbook, write letters home to mom and dad, zap aliens, maintain a mailing list, teach your children to say "la plume de ma tante," keep track of accounts receivable and payable, turn the coffee pot on in the morning, and so on.

These examples illustrate the end result of computer programs. A program is the proper arrangement of words and symbols of a given computer language that results in some task being performed. Each language has its own words and symbols, as well as its own rules for combining them.

The most common programming languages available for the Radio Shack computers are Basic, Assembly, For-

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- Transfers old files over to our system. ← **LOOK!**
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- Less than 5 digit zips have leading 0's appended.
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- Backup data disks are easily updated as entries are created, edited, or sorted...extremely useful!!
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tran, Cobol, Pascal, APL, Forth, Logo, Lisp, and Pilot.

Low- Versus High-Level Languages

In point of fact, though, your computer understands and interprets only one language—machine language. Everything else is an illusion. Machine language consists of numbers that your computer sees as commands directing it in a variety of simple tasks, such as adding two numbers together.

Although the numbers have specific meaning to the computer, they are not particularly meaningful to most people. You might learn that the number 201 is the command to return from a subroutine (in a Z80 microprocessor), but it is not inherently obvious.

In the beginning, man created computer programs in machine code with switches and plug boards. Now he uses a monitor that allows him to view and modify the numbers more readily.

The next step in computer language evolution was to assign more comprehensible symbols and words with the numbers. The result is Assembly language. The number 201 becomes the more memorable mnemonic RET—short for return. Assembly language is still low-level. Each mnemonic represents a single instruction to the machine.

In high-level languages, one line of code might represent many machine operations. Also, high-level languages often use complete words rather than mnemonics (RETURN, not RET) to make programs easier to read and understand.

Although this doesn't make much difference to the end user, it helps the programmer who has to maintain or modify a program code.

To emphasize the point, consider the problem of whiting out the video screen in three languages: machine code, Assembly, and Basic. The video screen location for the Models I and III are from 15360 to 16383.

Machine language:

```
33, 0, 60, 17, 1, 60, 1,
255, 3, 54, 191, 237, 176
```

Assembly language:

```
LD    HL,15360
LD    DE,15361
LD    BC,1023
LD    (HL),191
LDIR
```

Basic:

```
10 FOR X = 15360 TO 16383
20 POKE X,191
30 NEXT X
```

The machine-code version is on the obscure side. The Assembly program is clearer provided you understand what the mnemonics mean (for instance, LD means LOAD). On the other hand, the Basic program is comprehensible to nearly anyone who reads English.

You might not know what POKE means, but the routine is performing a loop with the value of X ranging from 15360 to 16383. Line 20 tells the machine to place the graphics character associated with the number 191—a solid white block—at screen location X. When the loop is finished, the screen is completely white.

While the Basic program is easier to write and understand, the machine- and Assembly-language versions have the distinct advantage of speed. Low-level languages run about fifty times as fast as high-level languages.

Method of Implementation

Machine language, once entered into the computer via a keyboard, is executed directly. No intermediate steps are involved. This is not true of any other computer language. But since all you work with is a series of numbers, it's difficult to edit or expand the original program.

To use Assembly language, you create the program in an editor, then run your creation through another program, an assembler. The result is an executable machine-language program.

An advantage to using the editor and assembler rather than machine language is the comparative ease of writing understandable code. Another is the ability to modify or expand the original program. Also, the editor allows you to change or delete old lines and insert new ones with relative ease. Finally, the assembler points out certain types of errors in your program.

TRS-80 Basic is a completely different matter. It allows you to create, edit, and execute your program. Like the assembler, it indicates errors as it encounters them.

However, when you run a program, it is "interpreted." The machine code to be executed is stored in your computer's ROM (read-only memory). Each Basic instruction in the program must be read and the associated variables stored in the appropriate memory locations. Then the corresponding machine code in ROM must be located and executed.

This process is repeated for every Basic instruction and must be repeated every time that instruction is encountered. That's why Basic is so slow.

Interpretation is not the only way to implement Basic in your computer. You can also use a Basic compiler. You create, maintain, and modify your Basic program with an editor. Then you run it through a compiler program. The end result is an executable machine-language program. Like the assembler and the interpreter, the compiler points out certain errors for you.

An advantage to this approach over interpreted Basic is speed. But the compiled program generally doesn't run as fast as a similar program written directly in machine or Assembly language.

While the end product in all three cases is machine code, the compiler is not as efficient because it does not comprehend your goal to white out the screen. It simply goes through your Basic program one instruction at a time, converting it to machine code.

Some ways of communicating in machine code take less time to perform than others. An experienced programmer with a thorough knowledge of the computer's machine-language instruction set often finds shortcuts based on his understanding of a problem. He sees the problem as a whole, while the compiler looks at it one piece at a time.

The human and the compiler are attempting to reach the same goals from completely different perspectives. The human is attempting to get the computer to white out the screen. The compiler is attempting to turn the Basic commands into machine language.

As a result, the human can usually compose a shorter, tighter program than the compiler. Since every machine-language instruction takes time to execute, the human-generated program runs faster.

Among the other common languages, APL, Logo, Lisp, and Pilot are generally implemented interpretively. Fortran and Cobol are usually compiled. Pascal is usually compiled to an intermediate code known as P-code. P-code is interpreted when you run your program.

Somewhat the same situation applies to Radio Shack's version of Cobol for the Models I and III. Their RUN-COBOL utility interprets your compiled Cobol program.

Forth is both a programming language and an operating system. It lies somewhere between the compiled/interpreted status of Pascal and a fully compiled language like Fortran.

History and Uses

- Basic

Basic, Beginner's All-purpose Symbolic Instruction Code, was developed as a language for use on a large time-shared computer system at Dartmouth

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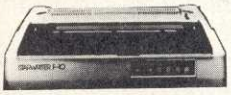

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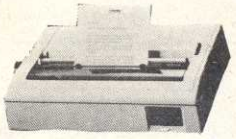

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College in the mid-1960s. It's a general-purpose language that's rather easy to learn in a short period of time.

It takes time, practice, and patience before you can write sophisticated programs. Since its creation, Basic has acquired many commands. Most of the string commands, PEEK, POKE, and random files are new.

A main advantage of Basic is that you can sketch out ideas for programs or complicated subroutines rather easily. This is a good approach before beginning a program in Assembly language.

Don't use Basic when it's not fast enough or when the program you have in mind would be large and complicated in Basic, but short and simple in some other language. Or when you have a listing of a program in Fortran. Or when you're taking a course in Cobol....

- Assembly

Assembly language is relatively hard to program but extremely fast. Most commercially available video games, particularly those with a lot of graphics and animation, are written either wholly or partly in Assembly language.

When you are programming in one of the higher-level languages, you do not have to pay attention to every detail regarding arithmetic and input/output operations. However, when you decide to use Assembly, you have to tell the computer exactly what you want it to do and how to do it.

For instance, if you want to put the word Hello on the video screen in Basic, use PRINT"Hello". In Assembly language you must tell the computer what to print, where the video screen is, and how to put it there. Assembly language runs 50 to 100 times faster, but it also takes you 50 to 100 times longer to write programs.

"Cobol is ideal for manipulating business data."

- Fortran

Fortran, FORmula TRANslation, was designed at IBM in the 1950s. It is the oldest commonly used higher-level language.

On the Models I and III, Fortran represents a good choice for intensive computation (number-crunching) tasks if Basic is too slow. It wasn't designed for string operations and the input/output is more difficult than Basic, but a lot easier than Assembly. Speed is its primary advantage.

- Cobol

Cobol is an acronym for COmmon Business Oriented Language. In a group effort, several computer manufacturers and the federal government developed it in the late 1950s. It is perhaps the most standardized of all the heavily used languages.

Cobol is ideal for manipulating business data. For example, standard Cobol (not Radio Shack's version) contains a sort verb. Point at the array you need sorted and say "SORT". It also contains a search verb for linear or binary searching. It allows long variable names, making it easy to write readable code.

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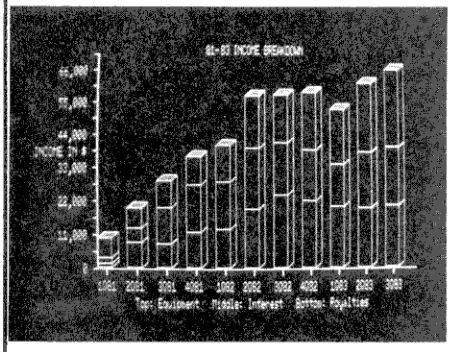

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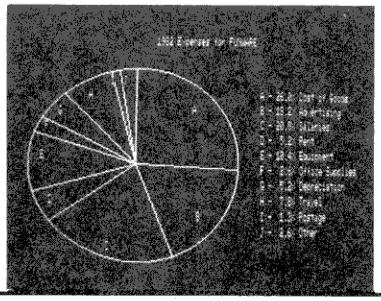

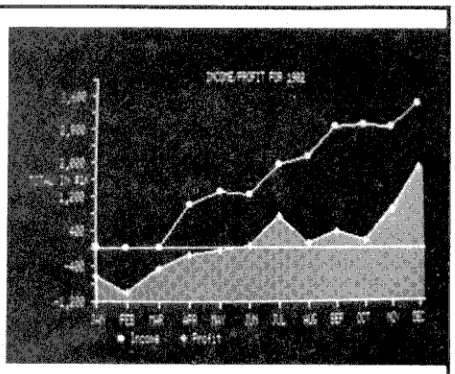

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can even redefine the field NAME to be an array called NAME ARRAY and look through it letter by letter to delete extra blank spaces.

The vast majority of all business programs running on mainframes and minicomputers are written in Cobol. Since it is compiled, Cobol runs fairly fast. And since Cobol code is easy to read (self-documenting), it's relatively simple to modify.

● Pascal

Pascal, named for the French mathematician Blaise Pascal, was created in the early 1970s as an educational tool. Pascal was intended to introduce students to computer programming. It's a structured language that almost forces a programmer to organize his program before entering it into the computer.

One of its strong points is its many different possible data types. You can add new ones as your program requires. For instance, you can establish the days of the week as one data type. Or you can declare a data type called DATE that includes automatic range checking for month (1–12), day (1–31), and year (0–99).

Like Basic, Pascal tries to be a general-purpose language. It is more tedious to program in than Basic.

● APL

APL, A Programming Language, was defined in 1962 by Dr. Kenneth Iverson. Originally, it wasn't so much a computer-programming language as a way of expressing mathematical concepts.

If you're interested in mathematical or engineering problems and can overcome the hurdle of its character set, APL might be for you. You can manipulate vectors and matrices without telling the computer how to do a matrix multiply. For jobs done repetitively, the interpretive nature of APL is a disadvantage, but it's great for quick-and-dirty jobs involving lots of math.

"Forth is strange, different, frustrating, and fascinating."

● Forth

Forth stands for fourth generation language. The second generation system on which it was developed permitted only five-character file names, so Fourth became Forth. Charles Moore developed it around 1970.

Forth is strange, different, frustrating, and fascinating. It requires an entirely different approach to programming, so you need time to get used to it.

One of Forth's big advantages is that it's an extensible language. A programming language consists of words and symbols, and the rules for combining them; in Forth, you can add new words and symbols that become as much a part of the language as the original ones.

You might take the initial language and add new features for specific applications. Perhaps you could add functions for controlling a telescope (TRACK, SIDEREAL TIME, POINT) in your home observatory, and develop a new dialect called Astro-Forth.

● Logo

Logo, from the Greek "*logos*," meaning *word*, is a way of teaching people (especially children) to interact with a computer. It is basically a graphics language. Like interpreted Basic, Logo provides an interactive mode and a programming mode.

Radio Shack's version of Logo for the Color Computer has two interesting features: recursion and multi-tasking.

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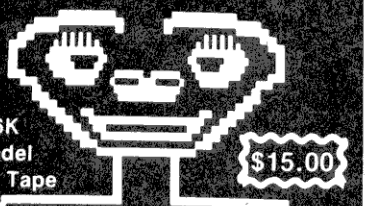

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```
10 INPUT "ENTER NUMBER "; N
20 GOSUB 1000
30 PRINT "FACTORIAL = "; F
40 GOTO 10
990 REM      FACTORIAL SUBROUTINE
1000 F = 1
1010 FOR X = 1 TO N
1020 F = F * X
1030 NEXT X
1040 RETURN
```

Program Listing 1. Basic

```
00100           ORG     7000H
00110 ;FACTORIAL SUBROUTINE
00120 ;PARAMETER IN B, RESULT IN HL
00130 FACT:     LD      HL,1
00140 FACT1:    CALL    MUL
00150           DJNZ    FACT1
00160           RET
00170 ;MUL - MULTIPLIES HL BY B
00180 ;RESULT IN HL, NO OVERFLOW
00190 MUL:      PUSH    BC          ;SAVE B
00200           LD      DE,0
00210           EX      DE,HL       ;DE HAS MULTIPLICAND
00220 MUL1:     ADD     HL,DE
00230           DJNZ    MUL1
00240           POP     BC          ;RESTORE B
00250           RET
00260           END
```

Program Listing 2. Assembly

Recursion allows you to write a program that refers to itself; for instance, you can draw a tree as a series of successively smaller branches.

Multi-tasking permits you to do several things at the same time. You can have two tasks drawing game pieces moving around the screen while a third task scans the keyboard for the players' moves.

● Lisp

Lisp, LISt Processor, operates on lists consisting of atoms, instead of on numbers. The atoms are arbitrary symbols that might be numbers but do not have to be.

Everything in Lisp is a list, even programs. This means that a Lisp program can operate on another Lisp program or even on itself. It was originally developed for, and is still used largely for, experiments in artificial intelligence.

● Pilot

Pilot is a limited language useful for developing multiple-choice type tests. It allows you to quickly create questions and answers for students. You can also use the computer to score the student while he takes a test at the terminal.

If you want to write programs to test people via a computer, Pilot might be the language you want to use. However, Pilot is very specific and has no other uses.

Sample Program—Factorials

To give you a better feeling for the nine languages discussed in this article (Pilot excluded), here is a set of programs to calculate factorials.

The factorial of any whole number is the result of multiplying together all the whole numbers from your original number down to one. It is expressed mathematically by using the exclamation point. 1! means 1 factorial.

$$1! = 1$$
$$2! = 2 \times 1 = 2$$
$$3! = 3 \times 2 \times 1 = 6$$
$$4! = 4 \times 3 \times 2 \times 1 = 24$$
$$n! = n \times (n-1) \times (n-2) \times \ldots \times 1$$

Now look at how you can get the computer to figure out factorials in each language. All the programs are fairly simple. (They do not include error-checking to be sure you always entered a whole number greater than or equal to one.)

Depending on the language, each program has an upper limit as to how large a factorial it can compute. (Factorials build up quickly.) We did not check for this upper limit in most cases. The idea is to help you compare getting the computer to calculate factorials in various languages.

Basic—Program Listing 1

This program has two parts. The first section, the main program, lets you enter a number and then print the factorial value for that number. The second part is a subroutine that calculates the factorial.

Line 10 uses the Input command along with the variable N for number. The computer prints "ENTER NUMBER" followed by a question mark, and waits until you type in a number and press enter. Enter the whole number for which you want the factorial.

Basic allows only distinct variable names of one or two characters. SU and SUM are the same variable since the first two characters are identical. This makes lengthy Basic programs somewhat difficult to read.

Line 20 then calls subroutine 1000, which figures out the factorial for N. Line 30 prints the factorial for N, called F for factorial, in the program. Line 40 sends you back to line 10 to enter another number.

Line 990 is a comment line, inserted to remind you that this next section is a subroutine used to calculate factorials. Line 1000 initializes the value of F to 1.

Line 1010 sets up a For. . . Next loop incrementing the value of X from 1 to the value of N. Line 1020 takes that present value of F and multiplies it by the present value of X. The result is stored back in F.

Line 1030 increases X by 1. If X is now greater than N, the program drops down to line 1040, the Return command. This takes you back to the command following the GOSUB that sent you here (in this case, line 30).

The first time through the loop, $F = 1$ and $X = 1$, so $F = F \times X = 1 \times 1 = 1$. If you go through a second time, X is incremented to 2. Therefore, $F = 1 \times 2 = 2$. If X is incremented to 3, you have $F = 2 \times 3 = 6$. This process continues until the value of X is greater than the value of N.

It is important to initially set F to 1 in line 1000. Otherwise, Basic would set F to zero by default. No matter how many times you multiply zero by other values, the answer is still zero. In addition, you need to set $F = 1$ at the beginning of the subroutine so it gets initialized every time you calculate another factorial.

Assembly—Program Listing 2

In essence, this listing is the Assembly

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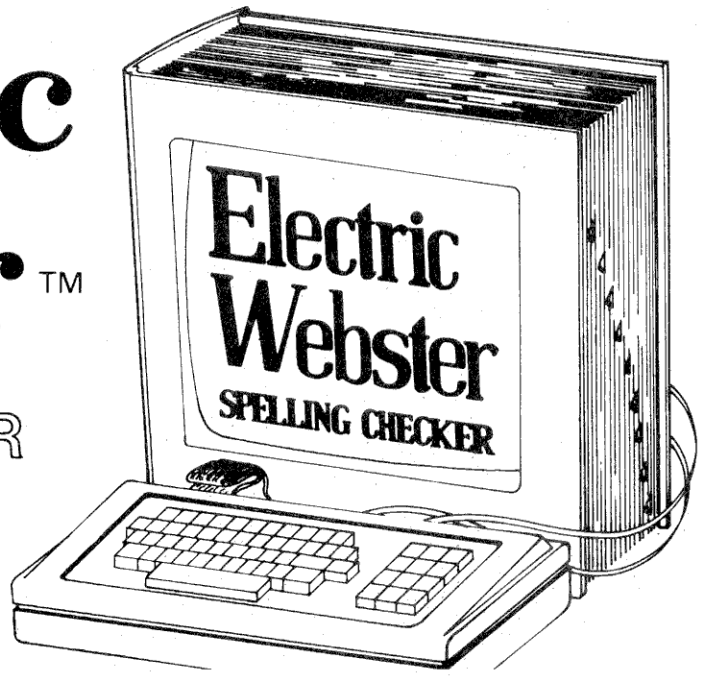

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```
00100   C       FACTORIAL PROGRAM
00110           DOUBLE PRECISION FACT
00120    10     WRITE(5,40)
00130           READ(4,50)NUMBER
00140           FACT=1
00150           DO 20 I=1,NUMBER
00160    20     FACT=FACT*I
00170           WRITE(5,60)FACT
00180           GOTO 10
00190    40     FORMAT('0ENTER NUMBER ')
00200    50     FORMAT(I2)
00210    60     FORMAT('0FACTORIAL = ',F10.0)
00220           END
```

Program Listing 3. Fortran

language equivalent of the Basic program's subroutine at line 1000. It is *not* a complete program.

The listing does not include a section allowing you to input the number to be factorialized, or an output routine to display the result on the screen. To include these would have made this program considerably longer and more complex.

The first line (ORG 7000H) informs the assembler that you wish it to place the machine-language program at memory location 7000 hexadecimal (hex). ORG stands for origin.

The four lines in the program that begin with semicolons are remarks. Several other lines have remarks at the end, also indicated with a semicolon.

The line numbers are the editor's line numbers. You use them when editing, deleting, or inserting lines. You cannot refer to them within the program.

Line 00130 is the first true line in the subroutine. Before you call this routine, you should have stored the number being factorialized in the B register. When you exit this subroutine, the factorial for B is stored in the HL register.

FACT is a label you can refer to within the program. In Assembly, you use labels in the same manner you use Basic line numbers. The rest of the line (LD HL, 1—load the HL register with 1) is equivalent to line 1000 in the Basic subroutine. It initializes the factorial to 1.

Line 00140 is labeled FACT1. It calls the subroutine labeled MUL below. Line 00150 (DJNZ FACT1) takes the place of the For . . . Next loop. It decrements the B register and, if the result is not zero, jumps back to FACT1.

Line 00160 (RET) is the same as the Return in Basic. The factorial has now been computed and stored in the HL register.

The actual computation gets a little tricky. Like most microprocessors, the Z80 only has a few registers to work with—A, B, C, D, E, H, L, IX, and IY. In addition, you have A' to L'. They all have different uses. As a result, you frequently have to save (PUSH) registers in memory on the stack. Keeping track of what's in each register can be confusing.

MUL multiplies the value in HL by the value in B and stores the result back in HL. This is the same as line 1020 in Basic. To keep it simple, the multiplication is in the form of repeated addition ($5 \times 4 = 5 + 5 + 5 + 5$).

Line 00190 saves the value of BC on the stack. Lines 00200 and 00210 move the present value of the factorial in HL into DE and zero HL for use as the

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27. *ZBASIC 2.2 Comes with CMDFILE/CMD program from MISOSYS, to allow appending or merging compiled programs and machine language programs from tape or disk.*

ZBASIC 2.2 DOES NOT SUPPORT THESE BASIC COMMANDS:

1. ATN, EXP, COS, SIN, LOG, TAN, and exponentiation. (However, subroutines are included in the manual for these functions.)
2. ERROR, ON ERROR GOTO, ERL, ERR RESUME.
3. No direct commands like AUTO, EDIT, LIST, LLIST ETC, although these commands may be used when writing programs.
4. Others NOT supported: CDBL, CINT, CSNG, DEFFN, FIX, FRE.
5. Normal CASSETTE I/O. (ZBASIC supports it's own SPECIAL CASSETTE I/O statements.)
6. SOME BASIC COMMANDS MAY DIFFER IN ZBASIC. For instance, END jumps to DOS READY, STOP jumps to BASIC READY etc.
7. MEMORY REQUIREMENTS: to approximate the largest BASIC program that can be compiled in your machine (at one time), enter BASIC and type: PRINT (MEM-6500)/2. Remember, you can merge compiled programs together to fill memory.

ZBASIC 2.2 SPEED COMPARISON DEMO

To help give you an idea how fast compiled programs are, we have included this demo program:

ZBASIC 2.2 DEMO PROGRAM

Time to compile and run complete program	**: 0 MIN. 2 SEC.**
BASIC Execution speed MOD 1, LEVEL II	**: 7 MIN. 34 SEC.**
ZBASIC Execution speed MOD 1, LEVEL II	**:0 MIN. 18 SEC.**
BASIC Program size (WITHOUT VARIABLES)	**: 895 BYTES**
ZBASIC Program size (WITHOUT VARIABLES)	**: 2733 BYTES**

(Remember that the ZBASIC program includes an 1879 byte subroutine package.) Program shown exactly as compiled and run in BASIC and ZBASIC.

```
10 '========= ZBASIC 2.2 EXAMPLE PROGRAM AND TIME TEST========
20 CLS:CLEAR100:DEFINT A-X:DEFSTR Z:DIM AA(64,24),Z(50):RANDOM
30 AA=100:BB=-1000:CC=3:DD=-3:EE=-9999:ST$="START TIME "+TIME$
40 FOR I=1TO127STEP2 :FOR J=47TO1STEP-3:XX=POINT(I,J):SET(I,J)
50 XX=(I-J)/CC*(7+I+J) :XX=ABS(INT(RND(I*J)-AA)+7) :RESET(I,J)
60 XX=PEEK(I+J) :POKE15360+I+J,J :OUT255,J AND (3*J):XX=INP(I)
70 AB$=STR$(I+J) :BA$=LEFT$(AB$,2) :AA(I/2,J/2)=VAL(BA$)+AA*3
80 BA$=BA$+RIGHT$(BA$,RND(3)) :XX=INSTR(1,BA$,"9"):XX=SQR(I*J)
90 BA$=MID$(BA$,2,2) :MID$(BA$,1,1)=Z :IF XX THEN 100 ELSE CLS
100 IF LEN(BA$))3 OR SGN(XX)=1 AND ASC(BA$)=32 THEN PRINT"+++";
110 IFPOS(0))62 THEN TRON:TROFF:PRINT ELSE XX=NOT(RND(99))+100
120 A$=INKEY$:IF A$="Y" OR A$="y" AND I)120 THEN PRINT"TRUE.."
130 RESTORE :READA,C,Z(J),D:GOSUB170:GOSUB170:GOSUB170:GOTO210
140 NEXT :PRINT"*";:NEXTI:CLS:PRINT@512,ST$,"STOP TIME ";TIME$
150 STOP' ============== END OF MAIN TEST LOOP ================
160 DATA 12345,-1,"TEST",-9999
170 ON RND(6) GOTO 180,190,200,180,190,200
180 RETURN
190 RETURN
200 RETURN
210 ON RND(9) GOSUB 180,190,200,180,190,200,180,190,200
220 GOTO140
```

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```
000100 IDENTIFICATION DIVISION.
000110 PROGRAM-ID.      FACTORIAL.
000120 AUTHOR.          BOB NICHOLAS.
000130 DATE-WRITTEN.    03/23/83
000140
000150* PROGRAM COMPUTES FACTORIALS FOR VALUES FROM 1 TO 19
000160
000170
000180 ENVIRONMENT DIVISION.
000190 CONFIGURATION SECTION.
000200 SOURCE-COMPUTER.     RS.
000210 OBJECT-COMPUTER.     RS.
000220
000230
000240 DATA DIVISION.
000250
000260 WORKING-STORAGE SECTION.
000270
000280 77  NUMBER-VALUE          PIC 9(2)     VALUE ZEROES.
000290 77  FACTORIAL-COUNT       PIC 9(2).
000300 77  FACTORIAL             PIC 9(18).
000310 77  PRINT-FACTORIAL       PIC ZZZ,ZZZ,ZZZ,ZZZ,ZZZ,ZZ9.
000320
000330
000340 PROCEDURE DIVISION.
000350
000360 00-MAINLINE.
000370     PERFORM 10-INPUT
000380         UNTIL NUMBER-VALUE = 99.
000390     STOP RUN.
000400
000410 10-INPUT.
000420     ACCEPT NUMBER-VALUE PROMPT.
000430     IF NUMBER-VALUE < 1 OR NUMBER-VALUE > 19
000440         DISPLAY "VALUE MUST BE FROM 1 TO 19"
000450     ELSE
000460         PERFORM 20-PROCESS
000470
000480 20-PROCESS.
000490     MOVE 1 TO FACTORIAL.
000500     PERFORM 30-FACTORIAL
000510         VARYING FACTORIAL-COUNT FROM 1 BY 1
000520         UNTIL FACTORIAL-COUNT > NUMBER-VALUE.
000530     MOVE FACTORIAL TO PRINT-FACTORIAL.
000540     DISPLAY PRINT-FACTORIAL.
000550
000560 30-FACTORIAL.
000570     COMPUTE FACTORIAL = FACTORIAL * FACTORIAL-COUNT.
000580 END PROGRAM.
```

Program Listing 4. Cobol

product in the present computation. Line 00220 (MUL1) adds DE to HL.

Line 00230 (DJNZ MUL1) decrements the B register and jumps back to MUL1 if the B register is greater than zero. This loop performs the actual repeated addition.

Line 00240 restores the B register. Line 00250 returns to line 150. Line 00260 (END) doesn't do anything at all. It is merely for the benefit of the assembler.

Fortran—Program Listing 3

In many ways, the Fortran program is similar to the Basic version. We did not use a subroutine for the factorial computation.

Fortran lets you assign variable names of up to six characters. NUMBER is for the input value and FACT is for the factorial result.

Line 00100 is a comment line indicated by the C. Line 00110 specifies that the variable FACT is to be a double-precision number. This allows you to calculate larger factorials than you could in the Basic and Assembly programs. (Something similar is possible in Basic by specifying DEFDBL F to make F a double-precision number.)

Line 00120 is labeled 10. The Fortran editor uses the lines in the first column. If you wish to refer to or go to a specific line in Fortran, you must supply the line number in this second column of numbers. You cannot go to the editor's line numbers.

Line 00120 says WRITE(5,40). All writes and reads in Fortran are referenced by LUNs—Logical Unit Numbers. LUN 5 is the Logical Unit Number for the TRS-80 video screen.

The 40 tells you to refer to the line numbered 40—not the editor line number in the first column, but the 40 you placed in the second column of numbers, editor line 00190.

This is a Format statement that formats what you are writing. In this case, it also contains what you are writing ('0ENTER NUMBER') enclosed in quotation marks. The zero in front of enter creates a line feed before printing.

Line 00130 says READ(4,50)NUMBER. This reads the value of the variable NUMBER that you'll type into the keyboard (LUN 4) as formatted in line 50. Line reference 50 (editor line 00200) is FORMAT(I2). The I2 specifies that you can enter a two-digit integer.

Line 00150 is the equivalent of the Basic For...Next loop. DO 20 I=1, NUMBER tells the computer to execute line 20 for I ranging from 1 to the value assigned to NUMBER. When it's finished, it drops to line 00170. There is no visible end to the loop like the Next command in Basic. DO takes the part of For and Next.

Line 20 (editor line 00160) takes the present value of FACT and multiplies it by the present value of I. This process is identical to the Basic subroutine.

Line 00170 (WRITE(5,60)FACT) writes the value of FACT to the screen (LUN 5) according to the format indicated in line 60 (editor line 00210). This prints the phrase 'FACTORIAL =' followed by the factorial. The program specifies a format of F10.0, a floating-point decimal number of up to 10 digits.

Line 00180 sends the program back to line reference 10 to accept another number. As in the assembler, the END in line 00220 is for the benefit of the Fortran compiler.

While the flow of the Fortran program is almost identical to the Basic version, the Fortran is more tedious in formatting the input and output.

Cobol—Program Listing 4

Cobol programs are divided into four specific blocks (called divisions): Identification, Environment, Data, and Procedure. Some of the divisions are further broken down into sections and paragraphs. Paragraph names and variables can be up to 30 characters long, making code very readable.

The Identification division holds general information on the program. It must contain the Program-ID paragraph assigning a name to the program. Other paragraphs, such as Author and Date Written, are optional. All Cobol program lines end in periods.

The Environment division specifies what computer the program was written on (source) and the system it is to run on (object). Other sections let you name

Continues on p. 92

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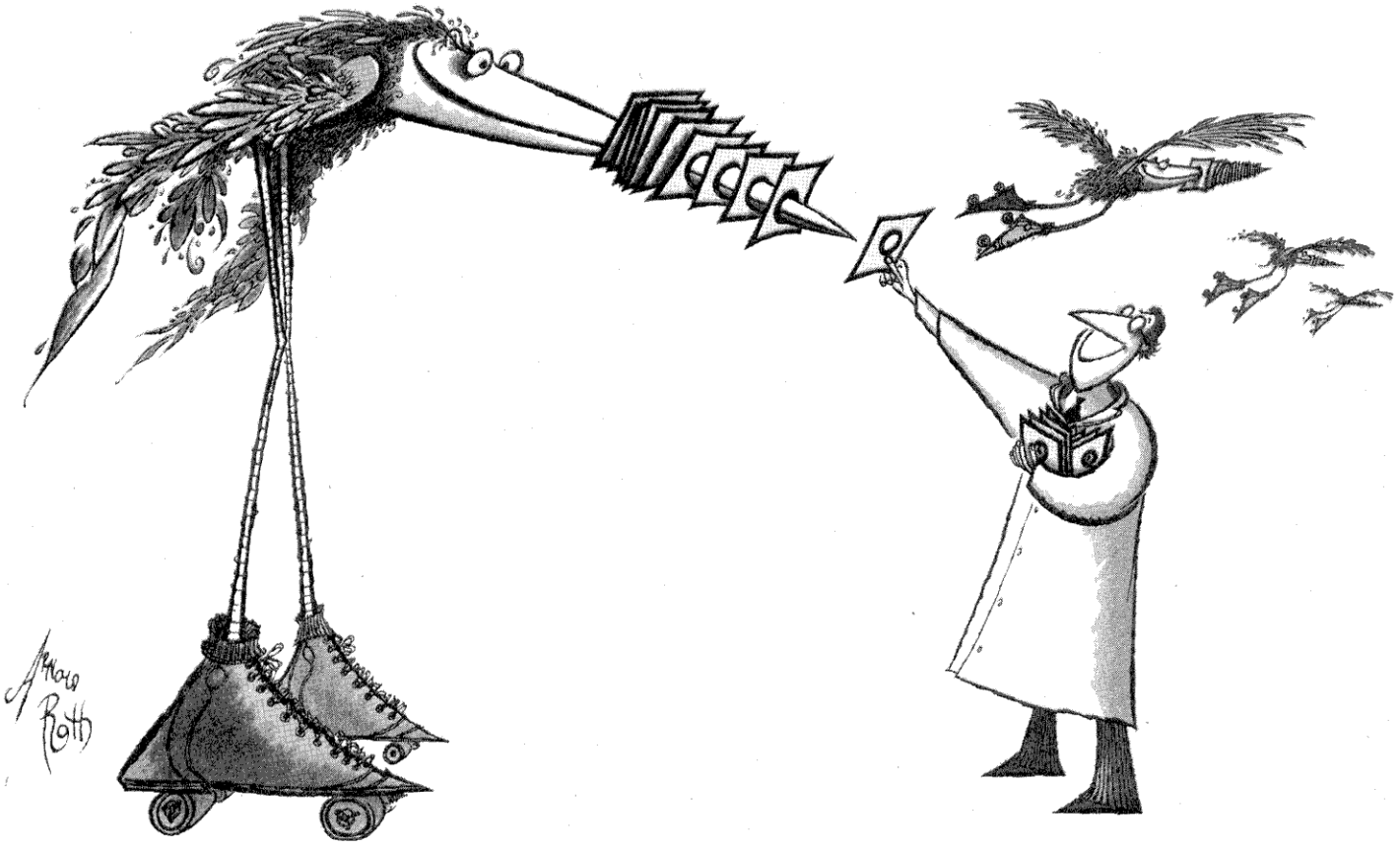

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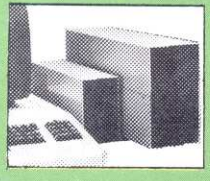

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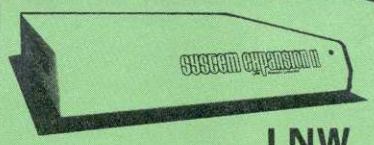

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```
PROGRAM TESTFACT;
VAR NUMBER: INTEGER;
FUNCTION FACTORIAL(N: INTEGER): INTEGER;
  VAR TEMPFACTORIAL,X : INTEGER;
  BEGIN
  TEMPFACTORIAL :=1;
  FOR X := 1 TO N DO
    TEMPFACTORIAL := TEMPFACTORIAL * X;
  FACTORIAL := TEMPFACTORIAL;
  END;
BEGIN (* MAIN PROGRAM *)
WHILE TRUE DO
  BEGIN
    READLN (NUMBER);
    WRITELN (FACTORIAL(NUMBER));
  END;
END.
```

Program Listing 5. Pascal

Continued from p. 88

the files to be used, hexadecimal constants, and special conversion names (for example, commas rather than decimal points in numbers).

You must define all file descriptions and variables in the Data division. You can break this division down into three possible sections: File, Working-Storage, and Linkage.

The File section contains a field-by-field description of each file used in the program. Any other program variables are specified in the Working-Storage section. The Linkage section indicates variables to be passed to external subroutines.

The Working-Storage section of this program describes four variables. NUMBER-VALUE is a two-digit number initially set to zero. (In Cobol, 9(2) specifies a two-digit numeric field; X(2) indicates a two-character alphanumeric field.) The number to be factorialized is stored in NUMBER-VALUE.

FACTORIAL-COUNT serves the same function as the X in the Basic For...Next loop and the I in the Fortran Do loop.

FACTORIAL is the result; it's set up to hold 18 digits. PRINT-FACTORIAL displays the value of FACTORIAL on the screen. The commas make the results easier to read, and the Z's allow zero suppression.

The actual program is in the Procedure division. The procedure is subdivided into four paragraphs. All paragraph names in the previous three divisions are predefined system names. However, you make up your own names for the paragraphs in the Procedure division. You can preface the paragraphs with numbers, but it's not mandatory. The first paragraph name (line 000360) could also be HEY-GANG-I START-HERE.

The 00-MAINLINE paragraph tells the computer to perform paragraph

```
0:    FACTORIAL
1:    BEGIN :'ENTER NUMBER ';
2:    N←⍞
3:    F←!N
4:    F
5:    →BEGIN
```

Program Listing 6. APL

10-INPUT until you enter the number 99. This is like Basic's GOSUB command. As in Fortran, you must refer to paragraph names rather than to the editor's line numbers.

Line 000420 accepts a value for NUMBER-VALUE from the keyboard. The word PROMPT produces two underline symbols on the screen where you are to type. (Two because NUMBER-VALUE was defined as two digits.)

Lines 000430–000460 check to be sure the number is in the range of 1 to 19. Anything above 19 requires more than 18 digits to compute. If the number is in the range, the program passes on to the 20-PROCESS; otherwise it returns to accept another input.

Line 000490 initializes FACTORIAL to 1, as did line 1000 of the Basic program.

Lines 000500–000520 are equivalent to the Basic For...Next loop ranging from 1 to NUMBER-VALUE. The difference here is that execution jumps out of the loop to perform the actual computation in 30-FACTORIAL.

To display FACTORIAL with zeros suppressed and commas, the program must first MOVE it to PRINT-FACTORIAL (line 000530) and then display PRINT-FACTORIAL (line 000540).

Line 000570 does the actual computations, like line 1020 in the Basic listing.

Cobol programs tend to be lengthy. On the other hand, the code is quite readable, and the output is nice.

Pascal—Program Listing 5

The Pascal listing is 17 lines long—we'll refer to them as if they were numbered from 1 to 17.

Line 1 names the program TESTFACT. Note that logical lines in Pascal end in semicolons.

Line 2 defines a variable, NUMBER, as an integer. You can use long variable names in Pascal, although many versions of the language only recognize the first eight characters.

Line 3 defines a function (subroutine) called FACTORIAL that receives one integer parameter (N) and returns an integer value. In Pascal, all subroutines must be defined before the program's main part.

Line 4 defines two integer variables (TEMPFACTORIAL and X) only used within the function FACTORIAL.

Lines 5–10 are the actual function. In Pascal all blocks start with the word BEGIN and end with the word END.

Line 6 initializes TEMPFACTORIAL as 1, as did line 1000 in the Basic version.

Lines 7 and 8 are the same as the Basic For...Next loop.

Line 9 assigns the computed value for the factorial (T) to the function FACTORIAL to be passed back to the main part of the program below.

Line 10 ends the function FACTORIAL, and lines 11–17 are the main program.

Line 12 repeats lines 13–16 indefinitely. You can continue entering new numbers to be factorialized.

Lines 13 and 16 are the beginning and end of the block to input a number, execute the function FACTORIAL, and print the result.

In line 14, READLN (NUMBER) reads the value of NUMBER from the keyboard.

In line 15, WRITELN (FACTORIAL(NUMBER)) executes the function FACTORIAL above and writes the value returned on the video display. LN after the word WRITE tells the computer to do a line feed after the write.

Line 17 ends the main program.

APL—Program Listing 6

The APL version of this program is short because APL has a built-in factorial function—and we used it!

Line zero is the name of the routine (FACTORIAL). Line 1 is labeled BEGIN so execution jumps back to it. Again, the label name is your choice—it

could be HERE or START. This line also prompts you to enter a number.

Line 2 lets you input a number from the keyboard and stores it in the variable N. The .q stands for QUAD, responsible for numeric input. APL has its own unique character set that's impossible to implement on the TRS-80. QUAD is generally shown as a rectangular box.

Line 3 computes the factorial of N and assigns it to the variable F. Line 4 prints the value of F on the screen. Line 5 jumps back to the label BEGIN to let you enter another value.

APL doesn't stop there. You are not limited to entering a single number and getting a single result. You can enter more than one number, or even operations on sets of numbers, and get all their factorials. For example, enter 1 5 3, and you'll get 1 120 6 as a response.

Or you can enter .i 5 (the numbers from 1 to 5) and get their factorials as a result: 1 2 6 24 120.

Or you can enter 3 + 6 and get 9 factorial. Or. . . .

Forth—Program Listing 7

Again, there are no line numbers in Forth, but we refer to them as lines 1–5.

The colon in line 1 indicates that you are defining a function called FACT.

The definition does not include an input routine. For example, to find 3 factorial, you type 3 FACT and press enter.

Forth is a stack-oriented language. Forth, rather than the function FACT, places the 3 directly on the stack.

Line 2 adds 1 to the value on the top of the stack (stack = 4). Line 3 places 1 on the stack (stack = 1 4) and then swaps the top two numbers on the stack (stack = 4 1).

Line 4 places a 1 on the stack (stack = 1 4 1) and then DO takes the 1 and the 4 off the stack and holds them as the counters for the equivalent of the Basic For. . . Next loop. One important exception: The loop falls through when it equals the upper limit (4), not when it is greater than that limit. (This is why the program added the 1 in line 2.) The stack now holds 1.

The I * LOOP portion of line 4 performs the loop by putting the I index, initially 1, on the stack (stack = 1 1), multiplying the top two numbers on the stack, and leaving the result on the stack (stack = 1).

The I index is then incremented by 1 (from 1 to 2). This process of multiplication and incrementing the index continues until the I index equals 4 (stack = 6).

```
: FACT
  1 +
  1 SWAP
  1 DO I * LOOP .
;
```

Program Listing 7. Forth

```
TO FACT :M
  MAKE :T 1
  WHILE :M>1
  ( MAKE :T :T*:M
    MAKE :M :M-1
  )
  HT
  PRINT :T
END
```

Program Listing 8. Logo

```
(DEFUN FACT (N)
  (SETQ X 1)
  (DOUNTIL (COND
             ((EQ N 0) X))
    (SETQ X (MUL X N))
    (SETQ N (SUB N 1))
  )
)
```

Program Listing 9. Lisp

The period at the end of line 4 prints the number on top of the stack—the factorial. Finally, the semicolon in line 5 ends the definition of this function.

Logo—Program Listing 8

Again, the program doesn't have any line numbers, but we refer to them as lines 1–9. A Logo input section is possible but rather difficult to code, so we didn't include one. To get the factorial for 3, type in FACT 3.

Line 1 defines a program named FACT with one parameter :M. (Notice that all variable names begin with a colon in Logo.)

Line 2 initializes the value of :T to 1 (like line 1000 in the Basic program).

Lines 3–6 constitute a loop. In this case, the program moves backwards from the input number to 1. Where the other programs have calculated 3 factorial as $1 \times 2 \times 3$, this routine calculates $3 \times 2 \times 1$.

Line 4 sets :T equal to :T times :M, line 5 decrements the value of :M, and line 6 marks the end of the While loop.

Since Logo is a graphics language, it always places a turtle (a little graphics marker like a cursor) on the screen when it displays anything. Line 7 (HT) tells the computer to hide the turtle for a neater display.

Line 8 prints the factorial value :T, and line 9 ends the program.

You normally wouldn't use a language like Logo for numeric computations. It was designed for learning about programming in a graphics environment to make it attractive to children.

Lisp—Program Listing 9

Again, the Lisp version has no line numbers, but we refer to the lines as lines 1–8. There is no input within the program. To find 3 factorial, type (FACT 3).

The first line defines the function, FACT, with one parameter, N. Line 2 sets the variable X to 1.

Lines 3–7 are a loop to calculate the factorial. Like the Logo program, this version computes 3 factorial as $3 \times 2 \times 1$.

Lines 3 and 4 state that the loop (DOUNTIL) continues until the CONDition N = 0 occurs. When this happens, the value of X is returned and printed automatically.

Line 5 does the multiplication, leaving the result in X. Line 6 decrements the value of N, line 7 is the end of the DOUNTIL loop, and line 8 marks the end of the program.

The World Beyond

So there you have it. Nine programming languages (plus Pilot) are available for Radio Shack's computer systems (see Table 1).

Many other computer languages exist: Algol, Snobol, Slip, Mad, Ada, Jovial, Joss, PL/I, Quiktran, CAL, Comit, IPL, Formac, Dynamo, Simscript, GPSS, and Focal, to name a very few. Not many of these are readily available for your Radio Shack computer.

This article considered languages from only two points of view: low-level versus high-level, and the method of implementation. Other possible approaches include algorithmic and procedural languages, simulation languages, list processing languages, process-control languages, and so on.

The definition of a programming language is a source of endless argument. This article serves as a broad introduction to the concept of language as well as an exploration of some of the computer languages available to you. ■

Philip Martel can be reached at 748 Tyler St., Pittsfield, MA 01201.

Robert Nicholas can be reached at Z-B Lennox Heights, Lenox, MA 01240.

A Pascal Primer

by J.B. Harrell

Would you like to learn a little about Pascal programming while teaching your micro how to play a mean game of cribbage? Read on . . .

```
TYPE
   cardtype =
      RECORD
         suit  : 1..4; (subrange specified)
         card  : 1..13; (subrange)
         value : 1..10
      END;
   control = (state1, state2, state3); (symbolic scalar)
   controlstates = SET OF control; (set of states)
   hand = ARRAY [ 1..6 ] OF cardtype;
```

Figure 1

```
VAR
   hand1 : ARRAY [ 1..6 ] OF cardtype;
   hand2 : hand;
   hand3 : ARRAY [ 1..6 ] OF RECORD
                                suit  : 1..4;
                                card  : 1..13;
                                value : 1..10
                             END;
```

Figure 2

```
PROCEDURE change1 (p : INTEGER );
   BEGIN
      p := 2
   END;

PROCEDURE change2 ( VAR p : INTEGER );
   BEGIN
      p := 2
   END;
```

Figure 3

Structured programming relies heavily on formal data structures and program modules that are linked together to develop larger programs. Many languages support this type of programming, but none has the simplicity of Pascal.

Pascal is a compiled language, unlike Basic, which is interpreted. This means program development takes longer in Pascal, but the final code runs faster.

Well-written Pascal source programs require very few comments because they're naturally descriptive. This is a blessing for programmers who must decipher the work of another programmer (or try to read something you wrote several years ago).

Another benefit of Pascal is the compiled output code. If your compiler produces standard p-code, you can use the code on another computer without recompiling it. You only need an appropriate p-code interpreter in the host computer.

An Overview

Certain segments of a Pascal program must follow a rigorous order. In Basic, you can dimension an array anywhere in a program, and you can use variables before defining them. Pascal variables have only one format (which cannot be changed), and you must declare them before calling them.

Pascal is not a line-oriented language

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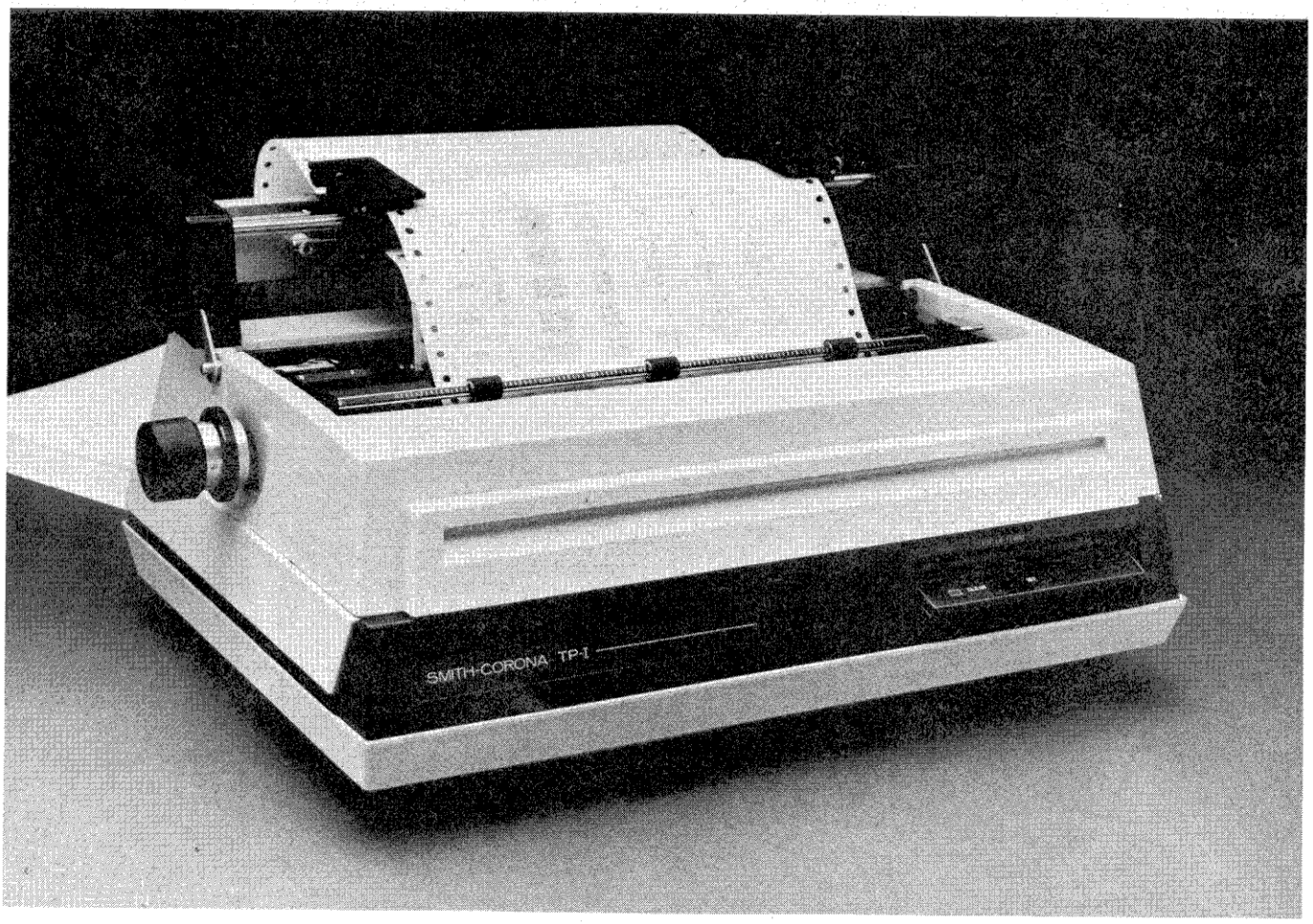

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Program Listing. Pascal Cribbage

```
{ CRIBBAGE plays the game of Cribbage using a graphical
  display of cards on the video screen.  It is you versus
  the computer in this game and you must be on your toes
  to win as the computer is sharp and will take all points
  that you do not count properly.

              Written by:

                    LCDR John B. Harrell, III
                    Portsmouth Naval Shipyard
                    Quarters 192-A
                    Portsmouth, NH 03801

Last modification: 27 March 1983 }

PROGRAM cribbage (input, output);

LABEL
  9999;

CONST
  zero = 48;     { ASCII character code for "0" }

TYPE
  cardtype =
    RECORD
      suit  : INTEGER;
      card  : INTEGER;
      value : INTEGER
    END;

VAR
  zs          : 1..4;        { card suit }
  zc          : 1..13;       { card value }
  zp          : 0..1023;     { screen print position }
  myhand      : ARRAY [ 1..6 ] OF cardtype;
  yourhand    : ARRAY [ 1..6 ] OF cardtype;
  workhand    : ARRAY [ 1..5 ] OF cardtype;
  cribhand    : ARRAY [ 1..4 ] OF cardtype;
  t7, t8, t9  : INTEGER;
  i, j, k, l  : INTEGER;
  v           : ARRAY [ 1..15,1..7 ] OF INTEGER;
  q           : ARRAY [ 1..11,1..6 ] OF INTEGER;
  r           : ARRAY [ 1..4,1..5 ]  OF INTEGER;
  s           : ARRAY [ 1..4 ]       OF INTEGER;
  played      : ARRAY [ 1..50 ]      OF INTEGER;
  cd, c1, c2  : INTEGER;
  c3, c4      : INTEGER;
  stot, hand  : INTEGER;
  crib        : BOOLEAN;
  score1      : INTEGER;
  score2      : INTEGER;
  deck        : ARRAY [ 1..52 ] OF INTEGER;
  p, m        : INTEGER;
  ch          : CHAR;


PROCEDURE printat (location : INTEGER);
  VAR
  temp : INTEGER;
BEGIN
  { set system cursor to the "location" specified }
  temp := 15360 + location;  { 3C00H + location }
  poke(16416,temp MOD 256);  { LSB to 4020H }
  poke(16417,temp DIV 256)   { MSB to 4021H }
END; { printat }


PROCEDURE delay (seconds : INTEGER);
  VAR
    i, j : INTEGER;
  BEGIN
    FOR j := 1 TO seconds DO
      FOR i := 1 TO 2000 DO
        { nothing }
  END; { delay }


PROCEDURE setup;
  BEGIN
    delay(2);
    zp := 458;
    printat(448);
    WRITE(chr(31),chr(13),'Play',chr(13),'Of The');
    WRITE(chr(13),'Hand:')
  END; { setup }
```

Listing continues

like Fortran or Basic. Its free-format style makes the source program very readable. Extra spaces, blank lines, and comments have no affect on program run time.

Pascal Program Structure

Pascal source programs comprise two parts: the heading and the block. The heading names the program and any files used in it. Pascal-80, an excellent TRS-80 Pascal, specifies actual file names. For example, the heading:

```
PROGRAM cribbage (input, output):
```

specifies that the program name is Cribbage and it will use the files Input and Output (keyboard and video screen).

The program block consists of the following six parts. All of these segments are optional but the last one:

- Label declaration
- Constant declarations
- Type definition
- Variable allocation and definition
- Procedure and function definition
- Program statements

Labels are unsigned integers used to locate and identify a particular segment of source code. A label is the target of the Pascal GOTO statement and is used for transfer control. No statements require labels and, in fact, some programmers consider labels bad form in structured programs.

Constant definitions assign a descriptive synonym to a constant. For example, the statement:

```
CONST zero = 48;
```

assigns the value of 48 to the symbolic representation of zero, which you can now use anywhere in the program. This is handy when you use the same constant repeatedly in the source code. You can assign constants values corresponding to any of the Pascal simple types, including character strings.

One powerful aspect of Pascal is the ability to define complex data types. These complex types are constructed of the simple *integer*, *real*, *Boolean*, and *character* types. The simple types are supplemented with subrange specifications, symbolic scalars, and sets.

Each type can be made more complex by using the *record* type to define an aggregate of different types. You can gather groups of a particular type together in an *array* of that type. For example, consider the type definitions in Fig. 1.

All program variables have to be named in the variable section. You can

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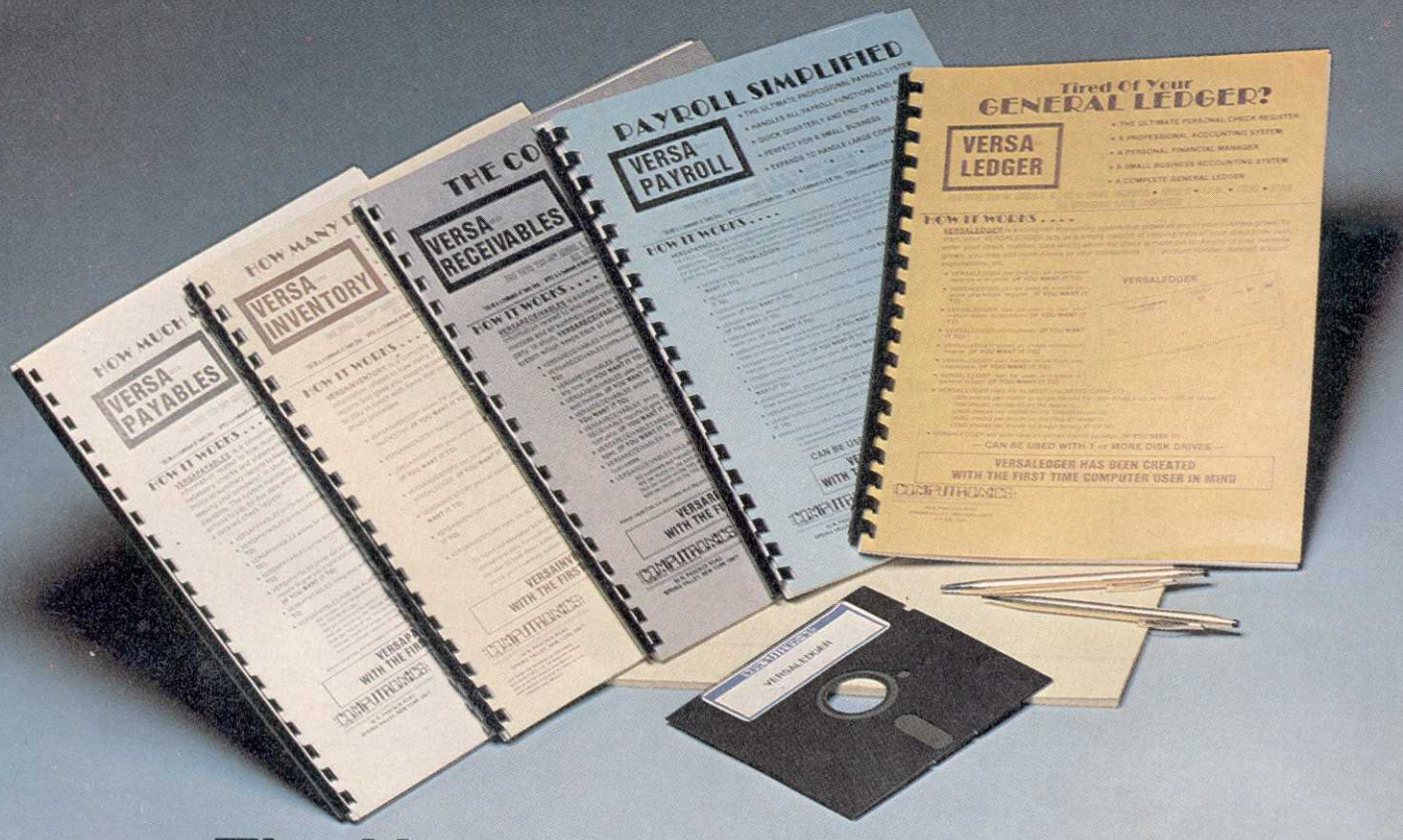

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Listing continued

```
PROCEDURE initarrays;

  PROCEDURE initv (row, v1, v2, v3, v4, v5, v6 : INTEGER);
    { array "v" is the array used to select the 4 out of 6
      cards in the computer's hand when evaluating for
      discard posibilities }
    BEGIN
      v[row,1] := v1;
      v[row,2] := v2;
      v[row,3] := v3;
      v[row,4] := v4;
      v[row,5] := v5;
      v[row,6] := v6;
      v[row,7] := 0
    END;  { initv }

  PROCEDURE initq (row, q1, q2, q3, q4, q5, q6 : INTEGER);
    { array "q" is used by "evaluate" to count all cards
      in runs of 3, 4, or 5 cards }
    BEGIN
      q[row,1] := q1;
      q[row,2] := q2;
      q[row,3] := q3;
      q[row,4] := q4;
      q[row,5] := q5;
      q[row,6] := q6
    END; { initq }

  PROCEDURE initr (row, r1, r2, r3, r4, r5 : INTEGER);
    { array "r" is used by "evaluate" to evaluate runs of
      4 out of the 5 cards in the hand }
    BEGIN
      r[row,1] := r1;
      r[row,2] := r2;
      r[row,3] := r3;
      r[row,4] := r4;
      r[row,5] := r5
    END; { initr }

  BEGIN { initarrays }

    initv( 1,1,2,3,4,5,6);
    initv( 2,1,2,3,5,4,6);
    initv( 3,1,2,3,6,4,5);
    initv( 4,1,2,4,5,3,6);
    initv( 5,1,2,4,6,3,5);
    initv( 6,1,2,5,6,3,4);
    initv( 7,1,3,4,5,2,6);
    initv( 8,1,3,4,6,2,5);
    initv( 9,1,3,5,6,2,4);
    initv(10,1,4,5,6,2,3);
    initv(11,2,3,4,5,1,6);
    initv(12,2,3,4,6,1,5);
    initv(13,2,3,5,6,1,4);
    initv(14,2,4,5,6,1,3);
    initv(15,3,4,5,6,1,2);

    initq( 1,1,1,1,2,3, 9);
    initq( 2,1,1,1,2,2,3,12);
    initq( 3,1,1,2,3,3,12);
    initq( 4,1,1,2,3,4, 8);
    initq( 5,1,2,2,2,3, 9);
    initq( 6,1,2,2,3,3,12);
    initq( 7,1,2,2,3,4, 8);
    initq( 8,1,2,3,3,3, 9);
    initq( 9,1,2,3,3,4, 8);
    initq(10,1,2,3,4,4, 8);
    initq(11,1,2,3,4,5, 5);

    initr(1,1,1,2,3,6);
    initr(2,1,2,2,3,6);
    initr(3,1,2,3,3,6);
    initr(4,1,2,3,4,4);

    { "evaluate" runs of 3 cards }
    s[1] := 1;
    s[2] := 2;
    s[3] := 3;
    s[4] := 3
  END;  { initarrays }


PROCEDURE drawsuit;

  PROCEDURE backspace;
    BEGIN
      WRITE(chr(26),chr(24),chr(24))
    END;
```

Listing continues

use any of the type definitions described above, including your own types, to define a variable. For example, the three variable definitions listed in Fig. 2 are identical.

Of the special types, symbolic scalars and sets are particularly important. As an example, consider the definition of the record subfield Suit above. Instead of defining Suit to have a subrange of 1..4, you could just as easily define suit as:

```
suit : (spades, hearts, diamonds, clubs);
```

You can assign the variable suit any one of the symbolic names of the suits. Statements such as the following are valid:

```
VAR i : suit;
. . .
FOR i := spades TO clubs DO . . .
```

You can define a *set* of any particular type. The example above is repeated here in compressed form:

```
VAR controlstates : SET OF (state1, state2,
state3);
```

This defines the set of all states that a model of a finite automata may contain. Then you can perform various set operations on the variables. This shortens the code significantly. For example, suppose you test the variable ch to see if it contains one of the following characters: 1, 2, 3, 4, 5, 6, G, or g. In Basic, you'd have to use several If statements. In Pascal, the following code using set makes the test:

```
IF ch IN ( ['1'..'6'] + ['g','G'] ) THEN. . .
```

The *record* type is the single most important data structure in Pascal. It lets you define complex data structures with minimum effort. Your hand in Cribbage is represented by the following data structure using records:

```
VAR yourhand : ARRAY [1..6] OF cardtype;
```

To reference the fourth element's card numerical value, you simply write the record name (followed by the array index) followed by a period, then the field name:

```
cvalue := yourhand [4].value;
```

Pascal procedures and functions are recursive (they can call themselves) and specify any number of most any type of parameter. Parameters can be passed to

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Listing continued

```
BEGIN { drawsuit }
  { suits are described by the variable "zs" as follows:
          1 - Spades
          2 - Hearts
          3 - Diamonds
          4 - Clubs            }
  CASE zs OF
    1:  WRITE(chr(160),chr(134),chr(164));
    2:  WRITE(chr(168),chr(137),chr(169));
    3:  WRITE(chr(160),chr(134),chr(164));
    4:  WRITE(chr(160),chr(158),chr(180))
  END;
  backspace;
  CASE zs OF
    1:     WRITE(chr(24),chr(130),chr(139),chr(131));
    2, 3:  WRITE(chr(137),chr(129));
    4:     WRITE(chr(138))
  END
END; { drawsuit }


PROCEDURE drawcard;
  VAR
    i : INTEGER;

  PROCEDURE backspace;
    BEGIN
      WRITE(chr(26),chr(24),chr(24),chr(24));
      WRITE(chr(24),chr(24),chr(24))
    END;

  BEGIN { drawcard }
    WRITE(chr(160),chr(176),chr(176));
    WRITE(chr(176),chr(176),chr(144));
    backspace;
    FOR i := 1 TO 4 DO
      BEGIN
        WRITE(chr(170),'    ',chr(149));
        backspace
      END;
    WRITE(chr(130),chr(131),chr(131));
    WRITE(chr(131),chr(131),chr(129))
  END; { drawcard }


PROCEDURE clearcard;
  VAR
    i : INTEGER;
  BEGIN
    FOR i := 1 TO 7 DO
      BEGIN
        WRITE('      ');
        WRITE(chr(26));
        WRITE(chr(24),chr(24),chr(24),chr(24),chr(24),chr(24))
      END
    END; { clearcard }


PROCEDURE layoutcard;

  PROCEDURE cardchar;
    BEGIN
      CASE zc OF
        1:   WRITE('A');
        10:  WRITE('T');
        11:  WRITE('J');
        12:  WRITE('Q');
        13:  WRITE('K')
        ELSE WRITE(chr(zero+zc))   { display number }
      END
    END;

  BEGIN { layoutcard }
    printat(zp);
    drawcard;
    printat(zp+65);
    cardchar;
    printat(zp+259);
    cardchar;
    printat(zp+129);
    drawsuit;
    zp := zp + 6
  END; { layoutcard }


PROCEDURE shutfle;
  VAR
    i, j, k, temp : INTEGER;
```

Listing continues

a subprogram in two ways: as value parameters or as variable parameters. Value parameters are passed to the processing routine and cannot be modified by it. Variable parameters can be modified by the called routine.

Consider the two procedures in Fig. 3. The procedure change1 does nothing to the parameter p; it is local. The procedure change2, however, changes the value of the variable assigned to p via the call to the value of 2.

The last section of a program (or function or procedure) is the statement section. This section is a compound statement comprising the keyword BEGIN, followed by any legal Pascal statements, followed by the keyword END.

Several types of statements exist: assignment statements, procedural calls, If decision statements, While looping control, Repeat looping control, Case selector statement, For looping control, GOTO statements, and any other Begin. . . End compound statement.

"Well-written Pascal source programs require very few comments. . . "

Structuring a program to function without GOTO statements means you must rely heavily on Pascal's looping control statements and flexible decision capabilities. The Pascal For statement is similar to Basic's, but control variables are restricted data types and the step value uses the successor (or predecessor) in the index variable's range. This is more complex than just saying that the step is +1 or −1. Note the following legal Pascal For statement:

```
VAR i : (spades, hearts, diamonds, clubs);
. . .
FOR i := spades TO diamonds DO <statement>;
```

You can control loops with the control variables range specified by a symbolic scalar. The statement may be any legal Pascal statement. The For statement has no effect if the starting value is greater than the ending value.

Other looping constructions in Pascal use the following two formats:

```
WHILE <expression> DO <statement>;
REPEAT <statement> UNTIL <expression>;
```

The While statement executes a Pascal statement while the condition specified

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18	RRCONST	Rate of return on investment with constant inflows
19	EFFECT	Effective interest rate of a loan
20	FVAL	Future value of an investment (compound interest)
21	PVAL	Present value of a future amount
22	LOANPAY	Amount of payment on a loan
23	REGWITH	Equal withdrawals from investment to leave 0 over
24	SIMPDISK	Simple discount analysis
25	DATEVAL	Equivalent & nonequivalent dated values for oblig.
26	ANNUDEF	Present value of deferred annuities
27	MARKUP	% Markup analysis for items
28	SINKFUND	Sinking fund amortization program
29	BONDVAL	Value of a bond
30	DEPLETE	Depletion analysis
31	BLACKSH	Black Scholes options analysis
32	STOCVAL1	Expected return on stock via discounts dividends
33	WARVAL	Value of a warrant
34	BONDVAL2	Value of a bond
35	EPSEST	Estimate of future earnings per share for company
36	BETAALPH	Computes alpha and beta variables for stock
37	SHARPE1	Portfolio selection model-i.e. what stocks to hold
38	OPTWRITE	Option writing computations
39	RTVAL	Value of a right
40	EXPVAL	Expected value analysis
41	BAYES	Bayesian decisions
42	VALPRINF	Value of perfect information
43	VALADINF	Value of additional information
44	UTILITY	Derives utility function
45	SIMPLEX	Linear programming solution by simplex method
46	TRANS	Transportation method for linear programming
47	EOQ	Economic order quantity inventory model
48	QUEUE1	Single server queueing (waiting line) model
49	CVP	Cost-volume-profit analysis
50	CONDPROF	Conditional profit tables
51	OPTLOSS	Opportunity loss tables
52	FQUOQ	Fixed quantity economic order quantity model
53	FQEOWSH	As above but with shortages permitted
54	FQEOQPB	As above but with quantity price breaks
55	QUEUECB	Cost-benefit waiting line analysis
56	NCFANAL	Net cash-flow analysis for simple investment
57	PROFIND	Profitability index of a project
58	CAP1	Cap. Asset Pr. Model analysis of project
59	WACC	Weighted average cost of capital
60	COMPBAL	True rate on loan with compensating bal. required
61	DISCBAL	True rate on discounted loan
62	MERGANAL	Merger analysis computations
63	FINRAT	Financial ratios for a firm
64	NPV	Net present value of project
65	PRINDLAS	Laspeyres price index
66	PRINDPA	Paasche price index
67	SEASIND	Constructs seasonal quantity indices for company
68	TIMETR	Time series analysis linear trend
69	TIMEMOV	Time series analysis moving average trend
70	FUPRINF	Future price estimation with inflation
71	MAILPAC	Mailing list system
72	LETWRT	Letter writing system-links with MAILPAC
73	SORT3	Sorts list of names
74	LABEL1	Shipping label maker
75	LABEL2	Name label maker
76	BUSBUD	DOME business bookkeeping system
77	TIMECLCK	Computes weeks total hours from timeclock info.
78	ACCTPAY	In memory accounts payable system-storage permitted
79	INVOICE	Generate invoice on screen and print on printer
80	INVENT2	In memory inventory control system
81	TELDIR	Computerized telephone directory
82	TIMUSAN	Time use analysis
83	ASSIGN	Use of assignment algorithm for optimal job assign.
84	ACCTREC	In memory accounts receivable system-storage ok
85	TERMSPAY	Compares 3 methods of repayment of loans
86	PAYNET	Computes gross pay required for given net
87	SELLPR	Computes selling price for given after tax amount
88	ARBCOMP	Arbitrage computations
89	DEPRSF	Sinking fund depreciation
90	UPSZONE	Finds UPS zones from zip code
91	ENVELOPE	Types envelope including return address
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93	INSFILE	Insurance policy file
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Listing continued

```
BEGIN
  cls;
  printat(471);
  WRITE('S H U F F L I N G');
  FOR i := 1 TO rnd(30)+15 DO
    BEGIN
      j := rnd(52);
      REPEAT
        k := rnd(52)
      UNTIL k <> j;
      temp := deck[k];
      deck[k] := deck[j];
      deck[j] := temp
    END
END; { shutfle }


PROCEDURE convert (cardvalue : INTEGER);
  BEGIN
    zs := (cardvalue - 1) DIV 13 + 1;
    zc := cardvalue - 13 * (zs - 1)
  END; { convert }
PROCEDURE cutfordeal;
  VAR
    cardnumber, yourvalue, myvalue : INTEGER;
  BEGIN
    REPEAT
      cls;
      WRITE('Please cut for deal (From 2 to 51):');
      READLN(cardnumber);
      WRITE(chr(15));
      if NOT (cardnumber IN [2..51])
        THEN
          BEGIN
            WRITELN('CUT IN THE DECK, PLEASE');
            delay(2)
          END
    UNTIL cardnumber IN [2..51];
    convert(deck[cardnumber]);
    yourvalue := zc;
    printat(384);
    WRITE('Yours -->');
    zp := 394;
    layoutcard;
    REPEAT
      j := rnd(50)+1
    UNTIL j <> cardnumber;
    convert(deck[j]);
    myvalue := zc;
    printat(414);
    WRITE('Mine -->');
    zp := 424;
    layoutcard;
    delay(3);
    IF yourvalue < myvalue
      THEN m := 1
      ELSE
        IF yourvalue > myvalue
          THEN m := 0
          ELSE
            IF yourvalue = myvalue
              THEN cutfordeal
  END; { cutfordeal }
PROCEDURE dealthehand;
  VAR
    k, l, y : INTEGER;
  BEGIN
    printat(984);
    CASE m OF
      0: WRITE('I am dealing');
      1: WRITE('You are dealing')
    END;
    m := 1 - m;
    y := 1 - m;
    delay(1);
    cls;
    zp := 74;
    printat(64);
    WRITE('Your Hand:');
    FOR i := 1 TO 6 DO
      BEGIN
        k := 2 * i - y;
        l := 2 * i - m;
        convert(deck[k]);
        myhand[i].suit := zs;
        myhand[i].card := zc;
        IF zc > 10
          THEN myhand[i].value := 10
```

Listing continues

by the expression is true (remember that a statement can be a series of statements bracketed by a Begin...End delimiter pair). The Repeat statement, on the other hand, executes the Pascal statement until the condition specified by the expression is true.

Note that if the expression is false on entry into each, the following will happen: While does nothing and Repeat executes the statement at least once.

Both simple and compound conditional statements are supported by the If and Case statements. The general form of the If statement is:

IF <expression>
THEN <statement>
ELSE <statement> (This is optional)

The statement can be any valid Pascal statement including another If statement.

The other type of conditional statement is Case. Case is an expression used to select the appropriate statement labeled with a constant value in the range of the selector. The general form of the Case statement is:

CASE <expression> OF
<constant> : <statement>;
<constant> : <statement>
END;

You could rewrite every Case statement using nested If statements, but this defeats the otherwise neat appearance of the program.

A Programming Example

Cribbage (see the Program Listing) is a Basic program adapted to TRS-80 Pascal. Sections of Cribbage are machine-dependent on the Model I or III. These areas use the addressing locations for the system cursor (procedure Printat) and the card-drawing routines which write graphics characters to the screen to draw the cards. To use this game on another computer, you will have to rewrite the following routines to conform to your computer's graphics: Drawsuit, Drawcard, Clearcard, and Layoutcard.

Pascal-80 provides several functions not part of standard Pascal. Cls clears the video screen, Random activates the random-number generator, Poke POKEs the byte value specified in the address provided, and Rnd returns a random number between 1 and the maximum number specified. You'll have to write routines to perform these functions if you don't have Pascal-80.

The procedure Initarrays sets up the array values used by the function Dis-

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Listing continued

```
            ELSE myhand[i].value := zc;
          convert(deck[l]);
          yourhand[i].suit := zs;
          yourhand[i].card := zc;
          IF zc > 10
            THEn yourhand[i].value := 10
            ELSE yourhand[i].value := zc;
          printat(12 + 6 * (i - 1));
          WRITE(i:2);
          layoutcard
        END
    END; { dealthehand }


PROCEDURE postscores;
  BEGIN
    printat(229);
    WRITE('My Score:',scorel:4);
    printat(291);
    WRITE('Your Score:',score2:4)
  END; { postscores }


PROCEDURE myscore (amount : INTEGER);
  BEGIN
    scorel := scorel + amount;
    IF scorel > 120
      THEN GOTO 9999
      ELSE postscores
  END; { myscore }


PROCEDURE yourscore (amount : INTEGER);
  BEGIN
    score2 := score2 + amount;
    IF score2 > 120
      THEN goto 9999
      ELSE postscores
  END; { yourscore }
PROCEDURE upcard;
  BEGIN
    CASE m OF
```

Listing continues on p. 108

card and the procedure Evaluate. Note that Pascal cannot read values from a Data statement, nor can it specify blocks of data in statements like Fortran does. This can be a significant hindrance.

The array v specifies the 15 combinations of the indexes of the six cards in the computer's hand. The function discard chooses the four cards with the highest count. The array q evaluates all combinations of runs in five cards. Array r catalogs runs that occur in four of the five cards. Array s is for runs of three cards in five.

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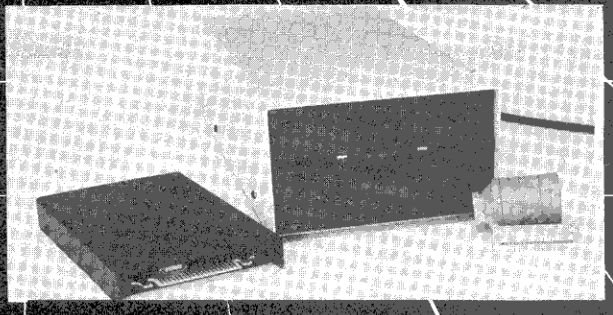

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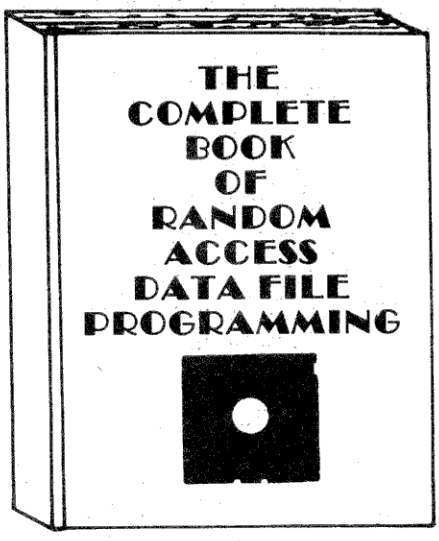

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```
          0:  i := rnd(37) + 14;
          1:  REPEAT
                printat(448);
                WRITE(chr(31));
                WRITE('It was my deal.  Please cut (14-51):');
                READLN(i);
                WRITE(chr(15));
                i := i + 1
              UNTIL i IN [14..51]
        END;
        convert(deck[i]);
        t9 := zc;
        t8 := zs;
        IF zc > 10
          THEN t7 := 10
          ELSE t7 := zc;
        zp := 116;
        printat(53);
        WRITE('*UP*');
        layoutcard;
        workhand[5].suit := t8;
        workhand[5].card := t9;
        workhand[5].value := t7;
        IF t9 = 11
          THEN
            BEGIN
              CASE m OF
                0:  BEGIN
                      printat(832);
                      WRITE('2 POINTS TO ME!');
                      myscore(2)
                    END;
                1:  BEGIN
                      printat(832);
                      WRITE('2 POINTS TO YOU!');
                      yourscore(2)
                    END
              END;
              delay(3)
            END
      END; { upcard }
      PROCEDURE evaluate;
        VAR
          result : INTEGER;
          d      : INTEGER;
          sum    : INTEGER;
          temp   : ARRAY [ 1..14 ] OF INTEGER;
          work   : ARRAY [ 1..5 ]  OF INTEGER;
          flag   : BOOLEAN;
          return : BOOLEAN;
        BEGIN
          p := 0;
          { check for Jack ot suit matching up-card }
          IF NOT crib
            THEN
              FOR i := 1 TO 4 DO
                IF (workhand[i].card = 11) AND
                   (workhand[i].suit = workhand[5].suit)
                  THEN p := 1;
          { check for all cards the same suit - in the crib
            hand, all cards including the up-card must match }
          flag := true;
          FOR i := 1 TO 3 DO
            IF workhand[i].suit <> workhand[i+1].suit
              THEN flag := false;
          IF flag
            THEN
              CASE crib OF
                true:   IF workhand[4].suit = workhand[5].suit
                          THEN p := p + 5;
                false:  IF workhand[4].suit = workhand[5].suit
                          THEN p := p + 5
                          ELSE p := p + 4
              END;
          { check for all combinations of cards that can add up
            to a total of 15 points.  Examine 2, 3, 4, and 5
            cards at a time to catch all combinations }
          FOR i := 1 TO 5 DO
            work[i] := workhand[i].value;
          FOR i := 1 TO 4 DO
            FOR j := i + 1 TO 5 DO
              IF (work[i] + work[j]) = 15
                THEN p := p + 2;
          FOR i := 1 TO 3 DO
            FOR j := i + 1 TO 4 DO
              FOR k := j + 1 TO 5 DO
                IF (work[i] + work[j] + work[k]) = 15
                  THEN p := p + 2;
          FOR i := 1 TO 2 DO
            FOR j := i + 1 TO 3 DO
              FOR k := j + 1 TO 4 DO
                FOR l := k + 1 TO 5 DO
                  IF (work[i] + work[j] + work[k] + work[l]) = 15
                    THEN p := p + 2;
          sum := 0;
          FOR i := 1 TO 5 DO
            sum := sum + work[i];
          IF sum = 15
            THEN p := p + 2;
          { count all the pairs, triples, and quadruples of cards
            held in the hand }
          FOR i := 1 TO 5 DO
            work[i] := workhand[i].card;
          FOR i := 1 TO 14 DO
            temp[i] := 0;
          FOR i := 1 TO 5 DO
            BEGIN
              j := work[i];
              temp[j] := temp[j] + 1
            END;
          FOR i := 1 TO 13 DO
            CASE temp[i] OF
              2:  p := p + 2; { pair }
              3:  p := p + 6; { triple }
              4:  p := p + 12 { quadruple }
            END;
          { sort the cards into ascending order for evaluation }
          FOR i := 1 TO 4 DO
            FOR j := i + 1 TO 5 DO
              IF work[i] > work[j]
                THEN
                  BEGIN
                    k := work[i];
                    work[i] := work[j];
```

Listing continues

Listing continued

```
            work[j] := k
          END;
{ evaluate all five cards for runs }
d := work[11 - q[1,1];
FOR i := 1 TO 11 DO
  FOR j := 1 TO 5 DO
    q[i,j] := q[i,j] + d;
return := false;
i := 1;
WHILE (i < 12) AND (NOT return) DO
  BEGIN
    flag := true;
    FOR j := 1 TO 5 DO
      IF work[j] <> q[i,j]
        THEN flag := false;
    IF flag
      THEN
        BEGIN
          p := p + q[i,6];
          return := true
        END;
    i := i + 1
  END;
IF NOT return { no runs occurred above }
  THEN
    BEGIN
      { evaluate runs of four cards at a time }
      1 := 0;
      WHILE (1 < 2) AND (NOT return) DO
        BEGIN
          d := work[1+1] - r[1,1];
          FOR i := 1 TO 4 DO
            FOR j := 1 TO 4 DO
              r[i,j] := r[i,j] + d;
          i := 1;
          WHILE (i < 5) AND (not return) DO
            BEGIN
              flag := true;
              FOR j := 1 TO 4 DO
                IF work[j+1] <> r[i,j]
                  THEN flag := false;
              IF flag
                THEN
                  BEGIN
                    p := p + r[i,5];
                    return := true
                  END;
              i := i + 1
            END;
          1 := 1 + 1
        END
    END;
IF NOT return { no run occurred above }
  THEN
    { evaluate runs of three cards at a time }
    FOR 1 := 0 TO 2 DO
        BEGIN
          d := work[1+1] - s[1];
          FOR i := 1 TO 3 DO
            s[i] := s[i] + d;
          flag := true;
          FOR i := 1 TO 3 DO
            IF work[i+1] <> s[i]
              THEN flag := false;
          IF flag
            THEN p := p + s[4]
        END
  END; { evaluate }


PROCEDURE setupcard;
  BEGIN
    workhand[5].suit := t8;
    workhand[5].card := t9;
    workhand[5].value := t7
  END; { setupcard }


PROCEDURE countmyhand;
  BEGIN
    cls;
    printat(64);
    WRITE('My Hand:');
    zp := 74;
    FOR k := 1 TO 4 DO
      BEGIN
        printat(12 + 6 * (k -1));
        WRITE(k:2);
        i := v[hand,k];
        zs := myhand[i].suit;
        zc := myhand[i].card;
        workhand[k] := myhand[i];
        layoutcard
      END;
    printat(53);
    WRITE('*UP*');
    zp := 116;
    zs := t8;
    zc := t9;
    layoutcard;
    setupcard;
    crib := false;
    evaluate;
    myscore(p);
    printat(448);
    WRITE('I have ',p,' points.');
    delay(6)
  END;
PROCEDURE countyourhand;
  VAR
    tmp : INTEGER;
  BEGIN
    k := 1;
    cls;
    printat(64);
    WRITE('Your Hand:');
    zp := 74;
    FOR i := 1 TO 6 DO
      IF (i <> c3) AND (i <> c4)
        THEN { card is not in the crib }
          BEGIN
            printat(12 + 6 * (k - 1));
            WRITE(i:2);
```

Listing continues

Listing continued

```
                zs := yourhand[i].suit;
                zc := yourhand[i].card;
                workhand[k] := yourhand[i];
                k := k + 1;
                layoutcard
              END;
        setupcard;
        crib := false;
        evaluate;
        printat(53);
        WRITE('*UP*');
        zp := 116;
        zc := t9;
        zs := t8;
        layoutcard;
        REPEAT
          printat(448);
          WRITE(chr(30),'How many points in your hand');
          READLN(tmp);
          WRITE(chr(15));
          k := p - tmp;
          IF k < 0
            THEN WRITE('TRYING TO HAUL TIMBER, HUH!!!!')
        UNTIL k >= 0;
        yourscore(tmp);
        IF k = 0
          THEN delay(3)
          ELSE { you mis-counted -- I get the rest }
            BEGIN
              printat(896);
              WRITE('*** M U G G I N S *** for ',k);
              WRITE(' points.');
              myscore(k);
              delay(3)
            END
      END; { countyourhand }


    PROCEDURE countcribhand;
      VAR
        tmp : INTEGER;
      BEGIN
        cls;
        printat(64);
        WRITE('Crib Hand:');
        zp := 74;
        FOR i := 1 TO 4 DO
          BEGIN
            workhand[i] := cribhand[i];
            zs := cribhand[i].suit;
            zc := cribhand[i].card;
            layoutcard
          END;
        setupcard;
        zs := t8;
        zc := t9;
        zp := 116;
        printat(53);
        WRITE('*UP*');
        layoutcard;
        crib := true;
        evaluate;
        CASE m OF
          0:  BEGIN  { your crib hand }
                REPEAT
                  printat(448);
                  WRITE(chr(30),'How many points in the crib');
                  readln(tmp);
                  WRITE(chr(15));
                  k := p - tmp;
                  IF k < 0
                    THEN WRITE('TRYING TO HAUL TIMBER, HUH!!!!');
                UNTIL k >= 0;
                yourscore(tmp);
                IF k = 0
                  THEN delay(3)
                  ELSE { you mis-counted -- I get the rest }
                    BEGIN
                      printat(896);
                      WRITE('*** M U G G I N S *** for ');
                      WRITE(k,' points.');
                      myscore(k);
                      delay(3)
                    END
              END;
          1:  BEGIN  { my crib hand }
                myscore(p);
                printat(448);
                WRITE('I have ',p,' points in the crib.');
                delay(6)
              END
        END
      END; { countcribhand }

    FUNCTION max (a, b : INTEGER) : INTEGER;
      BEGIN
        IF a > b
          THEN max := a
          ELSE max := b
      END; { max }
    FUNCTION discard : INTEGER;
      VAR
        t    : INTEGER;
        i    : INTEGER;
        ptmp : INTEGER;
        it   : ARRAY [ 1..15 ] of INTEGER;
        jt   : ARRAY [ 1..15 ] of INTEGER;
        flag : BOOLEAN;

      PROCEDURE checkforcards (kind : INTEGER);
        VAR
          ltmp : INTEGER;
        { Check for the type of card indicated by the para-
          meter "kind".  If there is only one hand having the
          type of card indicated then return flag true else
          return flag false }
        BEGIN { checkforcards }
          ptmp := 0;
          FOR i := 1 TO 15 DO
            jt[i] := 0;
          FOR i := 1 TO j DO
            BEGIN
              ltmp := it[i];
```

Listing continues

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Listing continued

```
            FOR k := 1 TO 4 DO
              BEGIN
                l := v[ltmp,k];
                IF myhand[l].card = kind
                  THEN jt[i] := jt[i] + 1
              END;
            ptmp := max(ptmp,jt[i])
          END;
        k := 0;
        FOR i := 1 TO j DO
          IF jt[i] = ptmp
            THEN
              BEGIN
                k := k + 1;
                ltmp := i;
              END;
        IF k = 1
          THEN
            BEGIN
              i := ltmp;
              flag := true
            END
          ELSE flag := false
      END; { checkforcards }

    BEGIN { discard }
      ptmp := 0;
      FOR i := 1 TO 15 DO
        BEGIN { evaluate all 15 different hands }
          FOR k := 1 TO 4 DO
            workhand[k] := myhand[v[i,k]];
          workhand[5].suit := 14;
          workhand[5].card := 14;
          workhand[5].value := 14;
          crib := false;
          evaluate;
          v[i,7] := p;
          ptmp := max(ptmp,p)
        END;
      j := 0;
      FOR i := 1 TO 15 DO
        IF v[i,7] = ptmp
          THEN
            BEGIN { count # of hands with highest count }
              j := j + 1;
              it[j] := i
            END;
      IF j = 1
        THEN discard := it[1] { hand is unique }
        ELSE
          BEGIN              { select the hand with the }
            flag := false;   { largest number of cards  }
            t := 1;          { indicated in the order   }
            REPEAT           { specified below          }
              CASE t OF
                1:  checkforcards(5);
                2:  checkforcards(8);
                3:  checkforcards(7);
                4:  checkforcards(11);  { Jacks }
                5:  checkforcards(1);   { Aces }
                6:  BEGIN  { select a hand at random }
                      flag := true;
                      i := rnd(j)
                    END
              END;
              t := t + 1
            UNTIL flag;
            discard := it[i]
          END
      END; { discard }


    PROCEDURE pegpoints;
      VAR
        tmp  : INTEGER;
        run  : INTEGER;
        flag : BOOLEAN;
      BEGIN  { peg points for the card last played }
        p := 0;
        IF cd > 1
          THEN
            BEGIN
              IF (stot = 15) OR (stot = 31)
                THEN p := p + 2;
              l := max(cd-2,2);
              i := cd;
              flag := false;
              REPEAT
                IF played[i] <> played[i-1]
                  THEN flag := true
                  ELSE
                    BEGIN { score matches of 2, 3, or 4 }
                      CASE (cd - i + 1) OF
                        1:  p := p + 2;
                        2:  p := p + 4;
                        3:  p := p + 6
                      END;
                      i := i - 1
                    END
              UNTIL (i < 1) or flag;
              IF cd > 2
                THEN
                  BEGIN { score runs of 3 or more cards }
                    run := 0;
                    FOR i := 3 TO cd DO
                      BEGIN
                        FOR j := 1 TO cd DO
                          played[j+10] := played[cd-j+1];
                        FOR k := 1 TO i DO
                          FOR l := k TO i DO
                            IF played[k+10] > played[l+10]
                              THEN
                                BEGIN
                                  tmp := played[k+10];
                                  played[k+10] := played[l+10];
                                  played[l+10] := tmp
                                END;
                        flag := true;
                        FOR k := 1 TO i - 1 DO
                          IF played[k+10] <> played[k+11]-1
                            THEN flag := false;
                        IF flag
```

Listing continues

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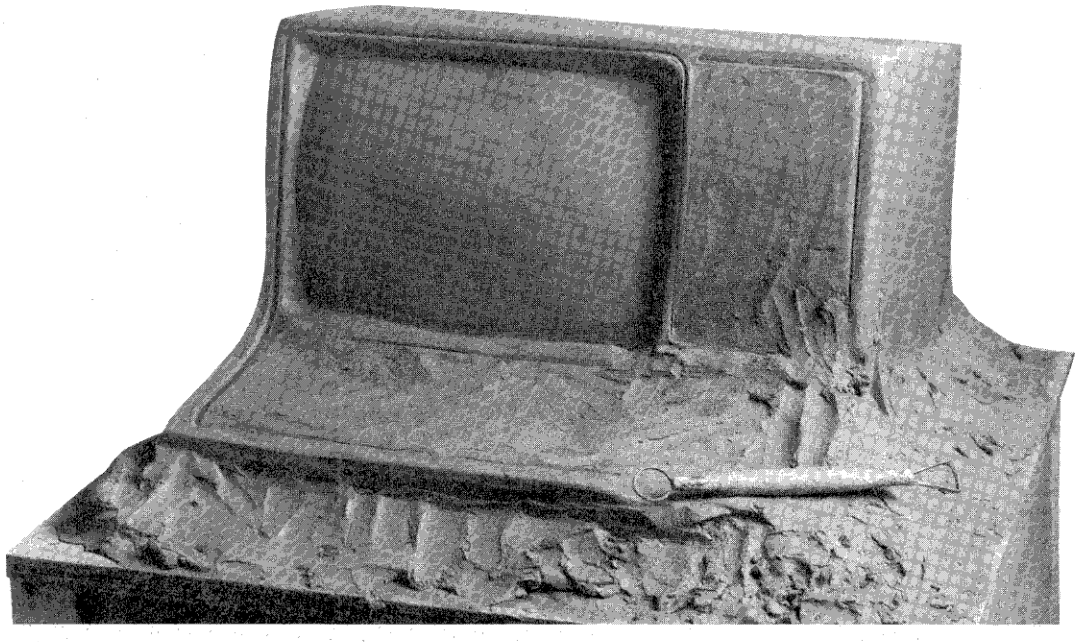

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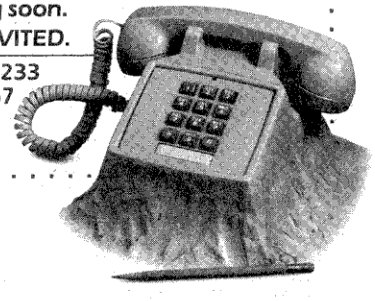

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Listing continued

```
                    THEN run := i
                  END;
                p := p + run;
              END
        END
END; { pegpoints }
PROCEDURE playthecards;
  VAR
    ycnt    : 0..4;        { number of your play }
    mcnt    : 0..4;        { number of my play }
    ich     : 1..6;        { your selection of play }
    f       : (you_last, me_last, no_one);
    goflag  : BOOLEAN;
    control : (yourplay, myplay, noplay,
               endofround, endofplay);
    ch      : CHAR;
    tmp     : ARRAY [ 1..50 ] OF INTEGER;

  PROCEDURE yourcard;
    VAR
      goodresponse : BOOLEAN;
    BEGIN  { yourcard }
      REPEAT
        delay(1);
        printat(832);
        WRITE(chr(30),'Your play: ',chr(14));
        REPEAT
          ch := inkey
        UNTIL ch IN ([ '1'..'6' ] + [ 'G','g' ]);
        WRITE(ch,chr(15));
        IF ch IN [ 'G','g' ]
          THEN goodresponse := true
          ELSE
            BEGIN
              goodresponse := true;
              ich := ORD(ch) - zero;
              IF (ich = c3) OR (ich = c4)
                THEN
                  BEGIN
                    WRITE(chr(13),'You threw THAT card in ');
                    WRITE('the crib -- TRY AGAIN!');
                    goodresponse := false
                  END;
              IF ycnt <> 0
                THEN
                  FOR j := 1 TO ycnt DO
                    IF tmp[j+10] = ich
                      THEN
                        BEGIN
                          WRITE(chr(13),'Already played -- ');
                          WRITE('TRY AGAIN!');
                          goodresponse := false
                        END;
              IF (stot + yourhand[ich].value) > 31
                THEN
                  BEGIN
                    WRITE(chr(13),'That totals more than 31');
                    WRITE(' -- ONCE MORE!');
                    goodresponse := false
                  END
            END
      UNTIL goodresponse;
      IF ch IN [ '1'..'6' ]
        THEN
          BEGIN
            stot := stot + yourhand[ich].value;
            ycnt := ycnt + 1;
            tmp[ycnt+10] := ich;
            cd := cd + 1;
            played[cd] := yourhand[ich].card;
            pegpoints;
            k := 10 + 6 * (ich - 1);
            IF ich > c3
              THEN k := k - 6;
            IF ich > c4
              THEN k := k - 6;
            printat(k);
            clearcard;
            zc := yourhand[ich].card;
            zs := yourhand[ich].suit;
            layoutcard;
            printat(896);
            WRITE(chr(31));
            WRITE('Your play gives a total of ',stot,'.  ');
            WRITE('You score ',p,' points.');
            f := you_last; { you played the last card }
            yourscore(p);
            IF stot = 31
              THEN
                BEGIN
                  f := no_one;  { set up new round of play }
                  cd := 0;
                  stot := 0;
                  goflag := false;
                  setup
                END
          END;
      control := myplay
    END; { yourcard }

  PROCEDURE mycard;
    VAR
      h, i, j, k : INTEGER;
      ptmp       : INTEGER;
      crd        : INTEGER;
      flag       : BOOLEAN;
    BEGIN { mycard }
      k := 0;
      ptmp := 0;
      crd := cd;
      cd := cd + 1;
      h := stot;
      FOR i := 1 TO 6 DO  { see if any cards can be played }
        BEGIN
          tmp[i] := 0;
          flag := true;
          IF (i = c1) OR (i = c2)  { card has been }
            THEN flag := false;    { discarded     }
          IF mcnt <> 0
            THEN  { scan cards already played }
              FOR j := 1 TO mcnt DO
                IF i = tmp[j+20]
                  THEN flag := false;
```

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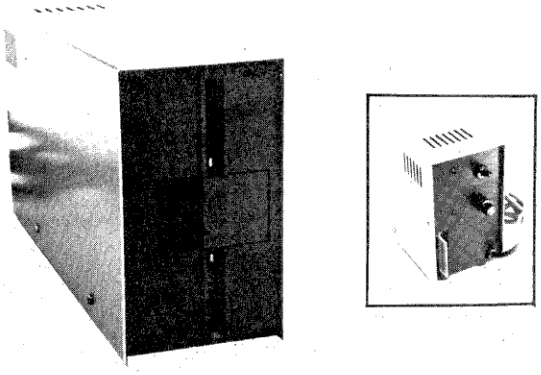

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Listing continued

```
IF (h + myhand[i].value) > 31
  THEN flag := false; { card totals more than 31 }
IF flag  { means there was a play }
  THEN
    BEGIN { score hand and save total for later }
          k := k + 1;
          stot := h + myhand[i].value;
          played[cd] := myhand[i].card;
          pegpoints;
          ptmp := max(p,ptmp);
          tmp[i] := p;
          tmp[k+30] := i
        END
  END;
cd := crd;
stot := h;
IF k <> 0  { there is a valid selection for play }
  THEN
    BEGIN
      cd := cd + 1;
      mcnt := mcnt + 1;
      IF (cd = 1) AND (mcnt = 1)
        THEN  { this is lst card  --  no fives }
          BEGIN
            flag := true;
            j := 1;
            WHILE (flag AND (j < 5)) DO
              BEGIN
                i := v[hand,j];
                IF myhand[i].card <> 5
                  THEN { card found that is not a 5 }
                    flag := false;
                j := j + 1;
              END; { while }
            IF flag
              THEN  { hand has nothing but 5's }
                BEGIN { select any one of them }
                  i := v[hand,1];
                  tmp[mcnt+20] := i;
                  played[cd] := 5;
                  stot := 5;
                  ptmp := 0
                END
              ELSE { there is a selection other }
                BEGIN { than a five }
                  tmp[mcnt+20] := i;
                  played[cd] := myhand[i].card;
                  ptmp := 0;
                  stot := myhand[i].value;
                END
          END
        ELSE { not the first card - }
            { scan for highest point count }
          BEGIN
            FOR j := 1 TO k DO
              BEGIN
                i := tmp[j+30];
                IF tmp[i] = ptmp
                  THEN h := i
              END;
            i := h;
                tmp[mcnt+20] := i;
                played[cd] := myhand[i].card;
                stot := stot + myhand[i].value
              END;
          zc := myhand[i].card;
          zs := myhand[i].suit;
          layoutcard;
          printat(896);
          WRITE(chr(30),'My play gives a total of ');
          WRITE(stot,'.  I score',ptmp,' points.');
          f := me_last;          { I played the last card }
          myscore(ptmp);
          IF stot <> 31
            THEN
              IF ch IN [ 'G','g' ]
                THEN control := myplay
                ELSE control := yourplay
            ELSE
              BEGIN
                f := no_one;      { reset for new round }
                stot := 0;
                cd := 0;
                setup;
                control := yourplay
              END
        END
      ELSE  { there are no valid plays for me }
        control := noplay
  END; { mycard }

BEGIN { playthecards }
  ycnt := 0;
  mcnt := 0;
  cd := 0;
  stot := 0;
  gotlag := false;
  setup;
  IF m = 0
    THEN control := myplay
    ELSE control := yourplay;

  REPEAT  { play out this round of cards }

    CASE control OF

      yourplay:  IF ycnt <> 4
                   THEN yourcard { you select a card }
                   ELSE
                     IF mcnt = 4
                       THEN control := endofround
                       ELSE control := myplay;

      myplay:    BEGIN
                   delay(1);
                   IF mcnt <> 4
                     THEN mycard { I select a card }
                     ELSE
                       IF ycnt = 4
                         THEN control := endofround
                         ELSE
                           IF NOT (ch IN [ 'G','g' ])
```

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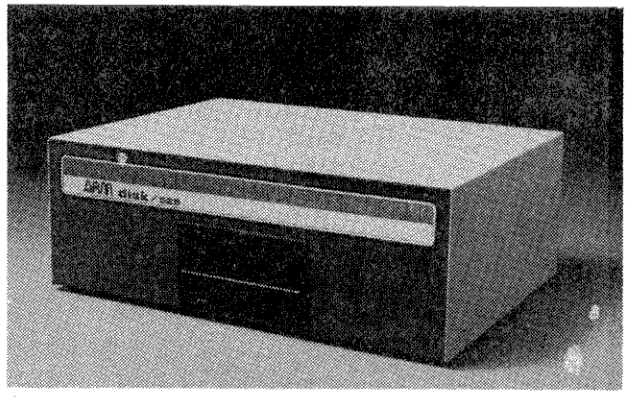

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Listing continued

```
                        THEN control := yourplay
                        ELSE
                          IF f <> me_last
                            THEN
                              BEGIN
                                printat(960);
                                WRITE('You get 1 ');
                                WRITE('point for ');
                                WRITE('last card.');
                                yourscore(1);
                                f := no_one;
                                cd := 0;
                                stot := 0;
                                setup;
                                control := yourplay
                              END
                            ELSE
                              BEGIN
                                printat(960);
                                WRITE('I get 1 point');
                                WRITE(' for last ');
                                WRITE('card.');
                                myscore(1);
                                f := no_one;
                                cd := 0;
                                stot := 0;
                                setup;
                                control := yourplay
                              END
              END;

noplay:       IF ch IN [ 'G','g' ]
                THEN
                  IF NOT goflag
                    THEN
                      BEGIN
                        printat(960);
                        WRITE('I get 1 point for ');
                        WRITE('last card.');
                        myscore(1);
                        cd := 0;
                        stot := 0;
                        setup;
                        control := yourplay
                      END
                    ELSE
                      BEGIN
                        printat(960);
                        WRITE('You get 1 point for ');
                        WRITE('last card.');
                        yourscore(1);
                        cd := 0;
                        stot := 0;
                        goflag := false;
                        ch := ' ';
                        setup;
                        control := myplay
                      END
              ELSE
                IF ycnt = 4
                  THEN
                    BEGIN
                      printat(960);
                      WRITE('You get 1 point for ');
                      WRITE('last card.');
                      yourscore(1);
                      cd := 0;
                      stot := 0;
                      goflag := false;
                      ch := ' ';
                      setup;
                      control := myplay
                    END
                  ELSE
                    IF goflag
                      THEN control := yourplay
                      ELSE
                        BEGIN
                          printat(896);
                          WRITE(chr(30),'** G O **');
                          goflag := true;
                          control := yourplay
                        END;

    endofround:BEGIN
                 printat(960);
                 CASE f OF

                   no_one:   { nothing required to do };

                   you_last: BEGIN
                               WRITE('You get 1 point');
                               WRITE(' for last card.');
                               yourscore(1)
                             END;

                   me_last:  BEGIN
                               WRITE('I get 1 point');
                               WRITE(' for last card.');
                               myscore(1)
                             END

                 END; { case of f }
                 control := endofplay
               END

  END { case of control }

UNTIL control = endofplay

END; { playthecards }

BEGIN { C  R  I  B  B  A  G  E }

  random;
  cls;
  WRITE(chr(15));
  printat(408);
  WRITE('C R I B B A G E');
  printat(538);
```

Listing continues

Listing continued

```
WRITE('Written by:');
printat(599);
WRITE('J. B. Harrell, III');
initarrays;
delay(2);
FOR i := 1 TO 52 DO
  deck[i] := i;     { break out a new deck of cards }
shuffle;
shuffle;            { mix them up good }

REPEAT  { start new game }
  score1 := 0;
  score2 := 0;
  shuffle;
  cutfordeal;

  WHILE true DO  { play this game }
    BEGIN
      shuffle;
      dealthehand;
      printat(448);
      WRITE('It is ');
      CASE m OF
        0: WRITE('your');
        1: WRITE('my')
      END;
      WRITELN(' crib');
      WRITELN;
      REPEAT
        REPEAT
          WRITE('Enter 1st discard number:');
          READLN(c3)
        UNTIL c3 IN [1..6];
        REPEAT
          WRITE('Enter 2nd discard number:');
          READLN(c4)
        UNTIL c4 IN [1..6]
      UNTIL c3 <> c4;
      WRITE(chr(15));
      IF c3 > c4
        THEN
          BEGIN
            k := c3;
            c3 := c4;
            c4 := k
          END;
      cls;
      printat(64);
      WRITE('Your Hand:');
      zp := 74;
      k := 0;
      FOR i := 1 TO 6 DO
        IF (I <> c3) AND (i <> c4)
          THEN
            BEGIN
              printat(12 + 6 * k);
              WRITE(i:2);
              zc := yourhand[i].card;
              zs := yourhand[i].suit;
              layoutcard;
              k := k + 1
            END;
      postscores;
      { select the discards from my hand }

      hand := discard;
      c1 := v[hand,5];
      c2 := v[hand,6];

      { set up the crib hands from the discards }

      cribhand[1] := myhand[c1];
      cribhand[2] := myhand[c2];
      cribhand[3] := yourhand[c3];
      cribhand[4] := yourhand[c4];

      upcard; { generate the up card for this round }

      playthecards; { play this round }

      CASE m OF { count the two hands in proper order }
        0: BEGIN
             printat(992);
             WRITE('*** I Score First');
             delay(2);
             countmyhand;
             countyourhand
           END;
        1: BEGIN
             printat(992);
             WRITE('*** You Score First');
             delay(2);
             countyourhand;
             countmyhand
           END
      END;

      countcribhand;

      printat(512);
      WRITE('I have ',score1,' points and ');
      WRITE('you have ',score2,' points.');
      delay(2)
    end; { while }

9999:  { somebody has won the game }

  printat(832);
  IF (score1 > 120)
    THEN
      WRITE('I WIN --- ',score1,' to ',score2,' points!');
  IF (score2 > 120)
    THEN
      WRITE('YOU WIN --- ',score2,' to ',score1,' points!');
  delay(5);
  WRITELN;
  WRITELN('Press <ENTER> TO play another game,');
  WRITE('Press <E> TO return TO DOS.');
  REPEAT
    ch := inkey
  UNTIL (ord(ch) = 13) OR (ch IN ['E','e'])

 UNTIL ch IN ['E','e']

END. { C  R  I  B  B  A  G  E }
```

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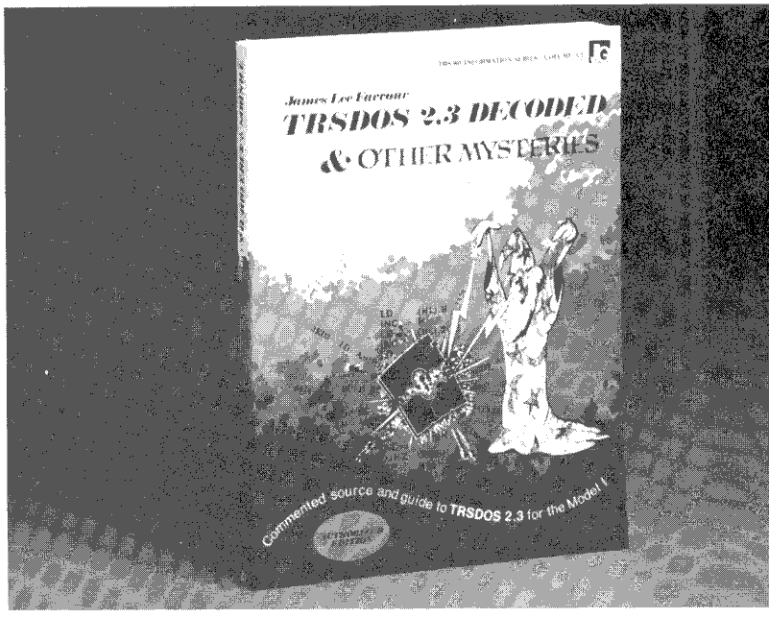

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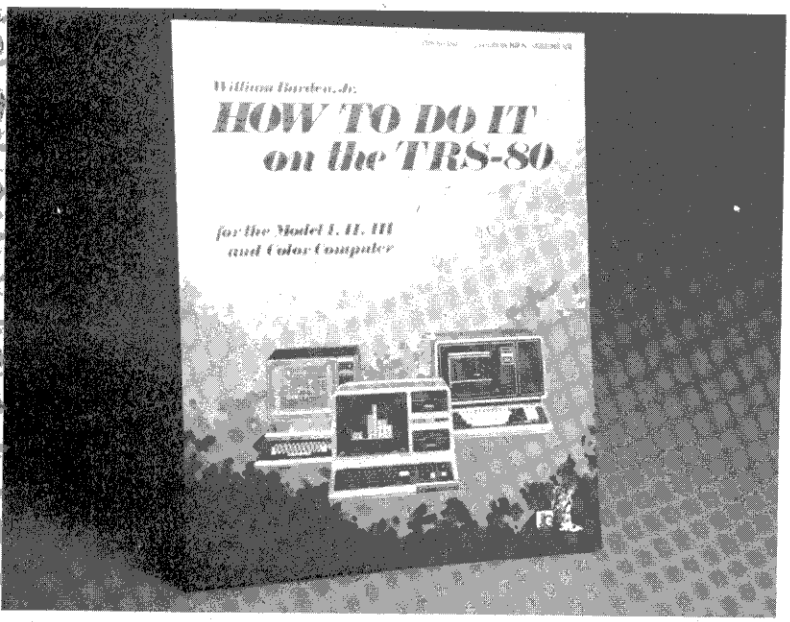

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The system is a natural upgrade for Model I owners since it offers CP/M while preserving their investment in disk drives and in much of their software. It is also completely at home in a business environment.

Not everyone, however, will appreciate this computer. Serious game players will find they can't use self-booting disks in the machine. In addition, although Model I graphics are supported and limited graphics are available in the CP/M mode, the Max-80 cannot presently display full-screen, high-resolution graphics, a deficiency that makes it unsuitable for some business uses.

Whatever your interests and needs, the details below will help you decide if this computer is for you.

Photo 1

Physical Characteristics

The Max-80 is basically a single-board computer housed, with its power supply, in an attractive, ivory-colored plastic case mounted on a steel baseplate. It complies with the radiation limits established by the FCC for Class A computing devices. Although this standard states that operation of complying equipment is likely to cause interference in residential areas, I have not encountered problems even with a television in the same room.

The footprint of the Max-80 is acceptably small, only 17½ inches wide and 10 inches deep. The top of the machine is 2 inches off the table top at the front and slopes gently upward to 3½ inches at the top of the keyboard. The rear of the case holds a line fuse and all the connectors and switches. The internal power supply operates on 110–115 volts ac and is efficient enough so that a fan isn't necessary to keep the electronics cool. The entire computer requires only 28 watts. Even after hours of continuous operation, the case is never warm to the touch.

Functional Characteristics

Except for an optional 64K bank of memory, the Max-80 is complete as it comes out of the box. There are no extra boards for disk interfaces, serial I/O, or video electronics. As a result, the machine's original cost is its only cost.

The machine is available with LDOS 5.1 and CP/M 2.2; much of the available Model I and Model III software are supported as is 8-bit CP/M software. This combination of operating systems provides access to a larger software base

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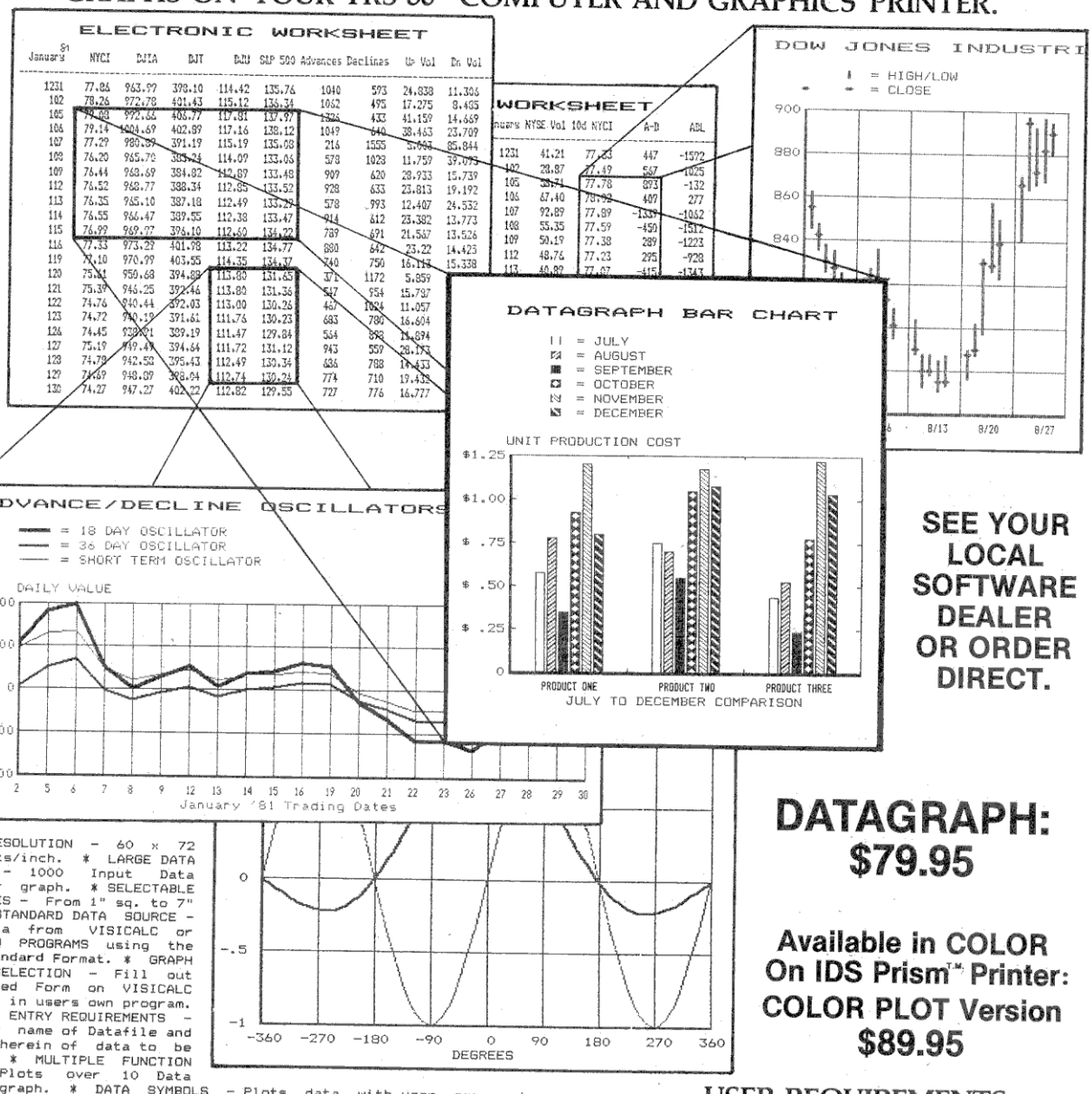

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- DOSPLUS 3.4, LDOS 5.1

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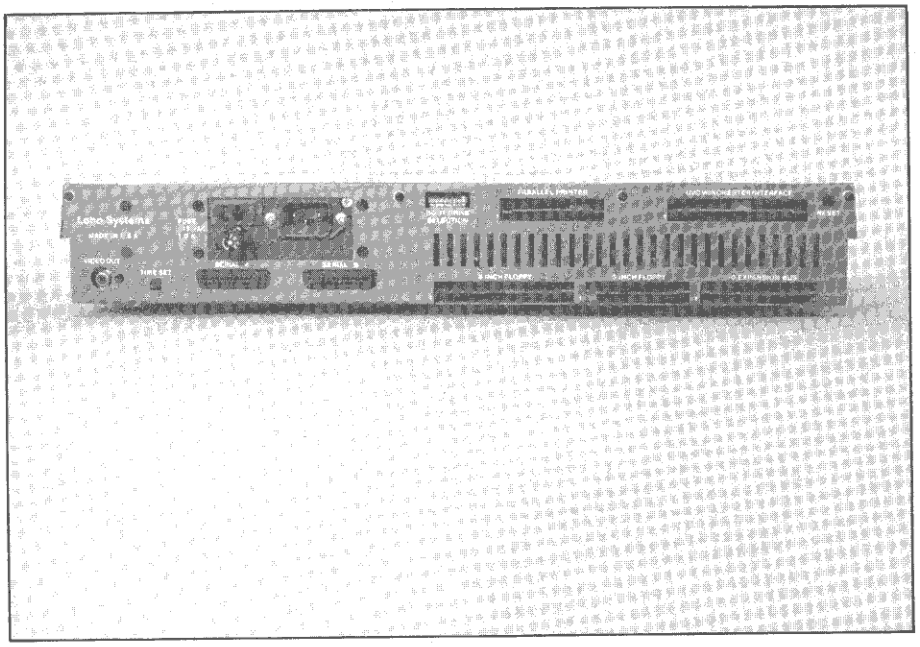

Photo 2

than that of most competing machines.

A Z80B running at 5.07 MHz gives the Max-80 its formidable processing power. This is nearly three times the speed of the Model I, 2½ times the speed of the Model III or the Softcard Apple, and 25 percent faster than the Model II or 12. The extra speed of the machine is readily apparent, especially with long-running programs or sorts. It has no impact, of course, on disk I/O since the disk transfer rate is set by the drive speed and not the processor. The reset button is conveniently located out of harm's way on the back of the case.

The Max-80's keyboard has a crisp feel and is a pleasure to use. You can input the entire ASCII character set directly, making awkward work-arounds unnecessary. The keyboard also includes control and escape keys, a 10-key numeric keypad with decimal point and enter keys, four programmable function keys, and a cursor-control block that includes a clear key. All ASCII keys are supported by auto repeat and the entire keyboard is fully debounced.

A real-time clock with internal, rechargable battery backup is a standard feature. The clock is software accessible and maintains month, day, year, and time in hours, minutes, and seconds. With the Max-80 turned off, the clock is maintained for up to six weeks. The backup battery claims a life of five years and is readily replaced through an access panel on the bottom of the computer.

The Max-80's RAM consists of one or two banks of 64K each, provided by eight or 16 Texas Instruments TMS 4164-20 chips. You can purchase the computer with the maximum 128K of RAM, but sockets for the second 64K bank are standard equipment and the additional chips are easily installed by even an inexperienced user.

The Max-80's only ROM contains a small bootstrap loader that disables once the system boots. As a result, the modified LDOS supplied with the system loads the bottom 12K of RAM with the code that resides in ROM on Tandy or LNW machines. Consequently, currently available self-booting disks don't operate on the Max-80.

Separate, gold-plated card edges are provided on the rear of the case for 5- and 8-inch floppy drives. Single- and double-density and single- and double-sided operation are available for both drive sizes and are supported by the built-in controller in both TRS-80 and CP/M modes. A slide switch mounted adjacent to the 5-inch disk connector controls pin 32, permitting it to select drive four or, alternatively, to act as the side-select signal when using double-sided drives. Track counts of 35, 40, 77, and 80 are supported on 5-inch disks and the standard 77 tracks on 8-inch disks.

A hard-disk interface is also included in the Max-80 and is available on a 50-pin, gold-plated card edge on the rear of the machine. This Shugart Associates Standard Interface (SASI) is designed to be used with an external controller. Both of the computer's operating systems are presently configured to use Lobo Systems' Universal Con-

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troller and do not support other controllers without modification.

Up to four drives in any combination can be used with LDOS; eight drives can be used with CP/M. Since so many disk options are available, a DIP (dual in-line package) switch is provided on the rear of the case so you can boot the operating system from the first 5-inch floppy, the first 8-inch floppy, a 5- or 8-inch hard disk, or a 5- or 8-inch floppy connected through the universal controller.

Serial I/O is provided through two independently programmable, built-in, RS-232 interfaces accessible through DB-25 connectors on the rear of the case. All standard baud rates up to 19,200 are supported. Either interface can be used to drive a serial printer.

Parallel printer output is available from a standard Centronics interface available on a card edge on the rear of the case. A slide switch adjacent to this port permits grounding or ungrounding pin 27 to adapt to printers (like the Epson MX-80) that interpret a grounded pin 27 as a request to generate a line feed after each carriage return.

An RCA phono jack provides video output. It drives any monitor that accepts 1 volt composite video from a 75 ohm source and provides 15,750 Hz horizontal and 60 Hz vertical sync frequencies.

Lobo recommends a monitor bandwidth extending from dc to at least 12 MHz to obtain good detail in the display. This is especially important in the CP/M mode, where the normal display is 80 characters by 25 lines. You can select a 40-character by 25-line display with a function key. In the TRS-80 mode, the display is a compatible 64 or 32 characters by 16 lines.

A fully documented system bus is also available on a 40-pin card edge on the rear of the case. You can use this to support additional peripherals although Lobo provides no direct support for this. Surprisingly, only the low-order eight address lines are available on the bus, somewhat limiting its utility.

Standard TRS-80 Model I graphics are supported by the LDOS operating system—the extended graphics of the Model III are not. In the CP/M mode, you can display up to 192 user-defined shapes. The first 128 shapes are limited to shapes that can be defined in the top half of a 8-by-16-dot rectangle. The remaining 64 shapes can be defined in a full 8-by-16-dot rectangle.

In normal use, the first 128 blocks are used to display the ASCII character set. By using the facilities provided, you can redefine any of these to accommodate foreign alphabets or special characters as desired. Redefining the character set is not simple, however, and is probably not feasible for anyone but an experienced Assembly-language programmer.

Operating Systems

The system's modified LDOS is supplied by Logical Systems Inc. and comprises the TRS-80 Model III version of LDOS 5.1 with minor changes to adapt it to the Max-80. These changes include modifications to the Date, System, and Time Library commands; the BACKUP/CMD, CMDFILE/CMD, and FORMAT/CMD utility programs; and the KI/DVR keyboard driver. Together, these changes accommodate the new real-time clock, the Max-80's more extensive storage and boot options, the full ASCII keyboard, and the absence of cassette I/O.

Several new programs are also provided including SETDATE/CMD and SETTIME/CMD, for setting or reading the real-time clock; MAX80/DCT, the drive-control table that contains the characteristics of the attached disk drives; and RS232M/DVR, the driver

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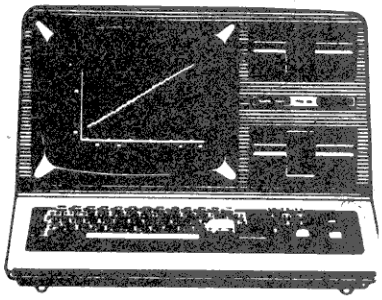

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program for the two RS-232 serial ports.

When using LDOS, the four function keys on the keyboard are not programmed to do anything. However, they return 81–84 hexadecimal (hex) and can activate functions in your own programs. In addition, when using the KI/DVR keyboard driver, both the control and escape keys are recognized—a real convenience.

CP/M 2.2, by Digital Research Inc., is entirely compatible with other CP/M 2.2 implementations. The Basic input/output system (BIOS) is written by Lobo and accommodates the specific hardware configuration of the Max-80. In addition, Lobo provides several utilities that enhance the ease of use of the Max-80 in the CP/M mode.

The xcopy.com command lets you format or copy floppy disks. All 5-inch disk track counts are supported and disks can be formatted in Lobo's single- or double-sided, double-density format or in Osborne, Xerox 820 or Omikron single-density, single-sided formats. Single-sided, single-density 8-inch IBM and double-sided, single- and double-density formats are also supported.

The program's xconfig.com is a powerful utility that reconfigures disk drives, remaps the existing keyboard, installs a new character set, reconfigures the serial ports, sets the default IOBYTE, and writes a reconfigured system to disk.

For Max-80s with the extra 64K bank of RAM, xconfig also lets you establish the extra bank of memory as a ninth drive, drive I, with 1K of directory and 63K of storage space. This RAMdrive is a very convenient place to put frequently used utilities.

The xhard.com utility formats 5- or 8-inch hard disks with or without built-in floppys. The xlock.com command provides the capability of locking out defective blocks on a hard disk using the manufacturer-supplied media defect sheet.

The xtime.com program sets the real-time clock. The remainder of the utilities are those normally provided with any CP/M system and include ed.com, asm.com, load.com, pip.com, stat.com, and movcpm.com.

Three of the function keys are preprogrammed when using CP/M. F1 toggles the caps lock on and off, F2 toggles between 80- and 40-character line lengths on the screen, and F4 slows the screen scroll so that you can read at your leisure.

The four cursor-control keys are not supported by CP/M. They do, however, return hex values that make the keys operational with some editors and word-processing programs. The up arrow returns 1C, the down arrow returns 1D, the left arrow returns 1D, and the right arrow returns 1F.

Documentation

At press time, the final documentation for the Max-80 was unavailable. The machine does, however, come with a very impressive and complete preliminary operation manual.

The first 55 pages of the manual describe how to set up the system and use the CP/M utilities unique to it. It also lists the CP/M video character and control codes, essential information for installing some editors and word processors such as Wordstar. In addition, it includes a helpful appendix that covers modifying floppy drive jumpers to make them compatible with the Max-80. Disk drives already configured for the Model I need no modification and operate "out of the box."

It is important to note that when using CP/M the video monitor is equivalent to a serial terminal and recognizes 18 different cursor and display control

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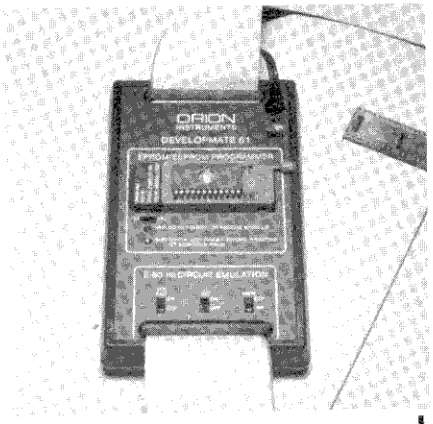

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Since the program is kept in TRS-80 RAM, changes can be made quickly and easily. When your stand-alone device works as desired, you use the Developmate's PROM PROGRAMMER to copy the program into a PROM. With this PROM, and a Z-80 in place of the emulation cable, your stand-alone device will work by itself.

The DEVELOPMATE is extremely compact: Both the PROM programmer and the In-Circuit-Emulator are in one small plastic box only 3.2" x 5.4". A line-plug mounted power supply is included. The PROM programmer has a "personality module" which defines the voltages and connections of the PROM so that future devices can be accommodated. However, the system comes with a "universal" personality module which handles 2758, 2508 (8K), 2716, 2516 (16K), 2532 (32K), as well as the new electrically alterable 2816 and 48016 (16K EEPROMs).

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codes, including direct-cursor addressing, high-lite, and low-lite. In effect, the monitor behaves like a SOROC IQ120 terminal and responds to all of its control codes.

The technical reference section of the manual provides descriptions of the Max-80 hardware, including a pin-by-pin description of the signals on each connector. It is followed by a system programmer's manual that details the steps involved in customizing the Max-80 to meet special requirements.

The final portion of the manual consists of seven appendixes containing the manufacturer's data sheets for the Z80 and the baud-rate generator, the serial I/O controller, the floppy disk controller, the clock/calendar, the parallel output controller, and the CRT controller. Two additional appendixes contain a complete schematic of the Max-80 and the source code for the bootstrap loader in ROM.

LDOS documentation consists of Logical Systems' standard 200-plus page manual for LDOS 5.1, supplemented by a six-page addendum describing the modifications made to LDOS for the Max-80.

In addition to the CP/M documentation in the preliminary operation manual, Lobo also includes a copy of the *Osborne CP/M User Guide* by Tom Hogan. This is provided instead of the usual CP/M manuals from Digital Research and is fully adequate for the first-time CP/M user.

Model I Compatibility

There is no way to provide a satisfactory or complete discussion of TRS-80/Max-80 compatibility. As a consequence, the discussion that follows is based on my experience with the computer during the past few months and is supplemented by information supplied by MAXIMUL, the Max-80 user's group.

Using LDOS in its TRS-80 mode, the Max-80 is a curious mixture of the Model I and Model III. File and directory formats and operating system entry points are identical to those with LDOS on the Model III. However, the printer is memory-mapped as in the Model I, rather than addressed through an output port as in the Model III. In addition, RS-232 serial I/O is provided by a Z80 SIO chip, rather than a UART chip as in the Tandy machines. This may introduce problems with some word processors and terminal programs.

The LDOS operating system includes two utilities, REPAIR/CMD and CONV/CMD, that are helpful in converting programs to the Max-80. The first of these modifies Model I disks so that they can be read by LDOS. The second copies Model III TRSDOS disks to LDOS formatted disks. Using these utilities, almost any Basic program converts and runs properly on the Max-80.

Assembly-language programs present more of a problem. Most, but not all, Assembly-language programs that run under, or have already been patched to run under, LDOS should run correctly on the Max-80. Some, such as the Radio Shack Series 1 Editor/Assembler, run without patching. If in doubt, arrange to try the software before you buy it!

Logical Systems does provide a $10 fix disk that includes patches for many popular programs. It is an excellent investment and lets you patch the following programs to run on the Max-80:

- Model I Scripsit—same features
- Model I Scripsit—adds enhancements
- Model I VisiCalc
- Model III VisiCalc
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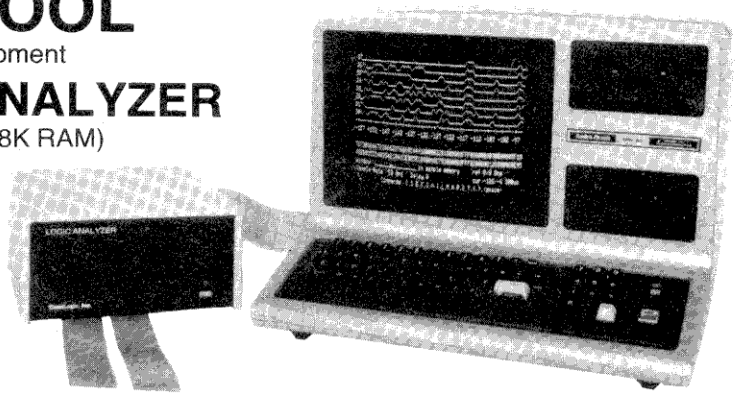

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- Model I Microsoft Macro-80 Assembler
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In addition, all Logical Systems, MISOSYS, and most PowerSoft software run on the Max-80 without patching, as well as Pascal80 from New Classics Software.

CP/M Compatibility

The issue of CP/M compatibility is not relevant since the Max-80's CP/M 2.2 is fully compatible with other implementations. It is important to know that the size of the Transient Program Area (TPA) on the Max-80 is 52,486 bytes if the Command Control Processor (CCP) is overwritten, 50,432 if it is not. As a consequence, CP/M application programs that require a 56K TPA cannot run on the Max-80 at present.

Moreover, since the Max-80 monitor acts like a serial terminal, some programs that make use of terminal control codes have to be patched to work. This is true unless they incorporate an installation procedure to tailor them to accommodate specific terminal codes.

One final area of incompatibility common to both the CP/M and TRS-80 modes should be noted. The Max-80 uses a Z80 SIO instead of a UART chip as the serial controller. Therefore, machine-language programs that use a serial port and attempt to program the UART will work only after major modification.

Support

The Max-80 is warranteed for one full year and can be repaired free of charge during that time. It is necessary, however, to return the machine to Lobo since they do not have repair facilities outside the factory. I have no reliable information on their repair turnaround time.

Lobo Systems maintains a technical support group that can be reached by phone during normal working hours. On the several occasions I called, the support staff was courteous and helpful, though not always reliable in returning calls.

For the most part, the staff has been able to answer all my questions on the Max-80 hardware and CP/M. LDOS questions are best taken up directly with Logical Systems' support group. It is unfortunate that neither Lobo nor Logical Systems provides a toll-free number for technical support—long distance charges add up quickly.

Another avenue of support for Max-80 owners is MAXIMUL, the Max-80 user's group. The group publishes an occasional newsletter with useful information on software compatibility, hardware modifications, and future Lobo Systems' plans. At the present time there are no membership dues.

MAXIMUL also distributes disks with user-developed software for the Max-80. Two are available at this time, MAXIMUL #1—CP/M utilities—$10 for one 8-inch disk or $15 for three 5-inch disks, and MAXIMUL #2—LDOS utilities at $10 on one 5-inch disk.

Help with the Max-80 is also available on CompuServe in section 2 of the LDOS SIG and section 5 of the XTRA-80 (QSD) SIG. Membership in the latter SIG is free to members of MAXIMUL.

Performance

My Max-80 has been used almost daily, usually several hours per day, since Christmas of 1982. It is attractively finished and professionally built, and has been "rock solid" during the entire time. The machine does everything that

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its advertising claims and is a delight to use.

Although the preliminary operation manual supplied with it is a bit fuzzy in some places, the necessary information is there and, if needed, a call to the Lobo support group usually clarifies any areas of uncertainty. I expect the final documentation to be outstanding.

Frustrations

I have experienced some frustrations with the Max-80, two major and one minor. The most troublesome problem has been the absence of full-screen, high-resolution graphics. In today's business environment, graphics displays play an increasingly important role. I can only hope that Lobo, or after-market suppliers, will provide a solution to this problem.

I also found it frustrating trying to determine what TRS-80 software is compatible with the Max-80. The machine hasn't been fully integrated into the TRS-80 software market yet. Software vendors either don't know of it or have no experience with it. Hopefully, as time passes, a larger share of the available, popular TRS-80 software will be patched and offered for sale in a compatible version. In the meantime, unless a particular software package is guaranteed to run on the Max-80, your safest bet is to assume that it does not.

A minor point of frustration concerns the location of the slide and DIP switches at the rear of the computer. These are mounted slightly inside the case and are not easily accessed.

Enhancements

Two enhancements are now in store for the Max-80. The most exciting is the imminent availability of CP/M Plus, which will be supplied to all current owners for $30. This operating system allows the use of the full 128K RAM and significantly enhances the CP/M capability of the machines.

After CP/M Plus becomes available, the Max-80 will only be sold with CP/M Plus and the full 128K of memory. Its base price will rise accordingly, to $945. At that time, Lobo is expected to drop support of the current CP/M 2.2 and will no longer offer it as an option.

LDOS users also have something to look forward to. In early spring, Logical Systems is expected to offer a software utility that permits you to load LDOS into the upper 64K bank of memory and operate it from there. This should make for a fast operating system. So far as I have been able to determine, the price for this utility has not yet been set.

Competition

The Max-80 has only two competitors, the LNW-80 and the Model III enhanced with any of the several available 64K CP/M boards. With respect to both of these machines, the Max-80 is faster, offers twice the memory, and is less expensive.

The competing machines do, however, offer Basic in ROM (the Max-80 does not) and the troublesome compatibility issue does not arise. All are fine machines.

The Max-80 is a well-built computer that delivers exactly what it promises. It fills a niche in which there are few competitors and offers access to a larger software base than that of any purely CP/M-based machine. It is available at a highly competitive price and directly supports a wider variety of floppy- and hard-disk storage options than any machine in its price class. ■

R.A. Langevin can be reached at 7621 Fontaine St., Potomac, MD 20854.

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Which Way the Wind Blows

by William Bunch and Robert J. Lisi

Record daily high and low temperatures and precipitation with this weather data base. Then use the data to plan your heating budget.

Program Listing 1

```
10 ' ********************************************
20 ' ********      WEATHER STATISITICS      ********
30 ' ********              BY               ********
40 ' ********          BILL BUNCH           ********
50 ' ********             AND               ********
60 ' ********          BOB LISI             ********
70 ' ********     CRANSTON, RHODE ISLAND    ********
80 ' ********         VERSION 2.0           ********
90 ' ********************************************
100 '
110 '
120 '
130 CLS:CLEAR0:ONERROR GOTO0:ONERROR GOTO 2540:CLOSE
140 CLEAR2000:DIMNN(366),H(366),L(366),R(366),MO(12),RJ$(12),X(3
65)
150 DATA -1,30,59,90,120,151,181,212,243,273,304,334
160 PRINT@534,"OPENING DATA FILES"
170 FOR MO=1TO12:READ MO(MO):NEXT:GOSUB2020:GOSUB2270:GOSUB2280
180 ' SET UP MASTER MENU
190 CLS:PRINT@0,TAB(32-LEN(RJ$(1))/2)RJ$(1):PRINT@64,TAB(32-LEN(
RJ$(2))/2)RJ$(2)
200 PRINT@128,TAB(32-LEN(RJ$(3))/2)RJ$(3):PRINT@256,LL$
210 PRINT@389,"<U>pdate specific date";TAB(40)"<A>dd data"
220 PRINT@453,"<I>nitialize new data file";TAB(40)"<S>tatistics
report"
230 PRINT@512,TAB(25)"<E>nd session":PRINT@576,LL$
240 PRINT@640,TAB(32-LEN(RJ$(4))/2)RJ$(4);
250 FL=1:GOSUB2340
260 ON INSTR("IAUSE",IN$)GOTO 280,370,540,780,2010
270 GOTO240
280 'INITIALIZE NEW DATA FILE
290 ONERROR GOTO 2540
300 CLS:PRINT@64,TAB(32-LEN(WN$(1))/2)WN$(1):PRINT@256,TAB(32-LE
N(WN$(2))/2)WN$(2)
```

Listing 1 continues

I first became interested in meteorology about 18 years ago. Before long I realized that I'd have to make daily observations to become an effective weatherman.

I obtained a maximum-minimum thermometer and an accurate rain gauge, and in 1965 I began keeping daily records. My parents took the daily readings if I was unable to be there.

In 1978 I purchased a TRS-80 Model I. I found that I could easily computerize the volumes of data I had collected.

My first program used sequential-access disk files. The program was fast and did everything I needed at the time. However, I soon decided that I wanted to be able to search between any two dates and compile certain statistical information.

I also wanted to be able to input my data whenever I had the time to do it. I realized that this would require random-access disk files.

The resulting program (see Program

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Listing continued

```
310 PRINT@399,"Do you wish to continue (Y/N)";:FL=1:GOSUB2340
320 ON INSTR("YN",IN$)GOTO340,190
330 GOTO320
340 PRINT@539,"SURE (Y/N)";:FL=1:GOSUB2340
350 IF IN$="Y" THEN360 ELSE IF IN$="N" THEN 190ELSE340
360 PRINT@661,"KILLING TEMP/DAT FILE":KILL"TEMP/DAT":GOTO 190
370 'ADD DATA RECORDS
380 CLS:PRINT@0,TAB(32-LEN(RJ$(1))/2)RJ$(1):PRINT@64,TAB(32-LEN(
RJ$(2))/2)RJ$(2):PRINT@128,TAB(32-LEN(RJ$(7))/2)RJ$(7):PRINT@256
,LL$
390 PRINT@520,"<I>nput new days or <R>eturn to master menu ";:FL
=1:GOSUB2340
400 IF IN$="I"THEN410ELSE IFIN$="R"THEN190ELSE390
410 IFLOF(1)=0THENPR=1:GOTO2310ELSE420
420 EN=LOF(1):PR=LOF(1)+1:GET1,EN:GOSUB2100:NN=D:GOSUB2140
430 PRINT@512,ES$:PRINT@448,TAB(32-LEN(RJ$(6))/2)RJ$(6)
440 PRINT@512,TAB(32-LEN(M$)/2)M$:NN=NN+1
450 PRINT@656,"How many days will be entered ";:FL=-3:GOSUB2340:
N=VAL(IN$):PRINT@650,EL$:M$=DA$
460 FOR I=1TON
470 GOSUB2140:D=NN
480 PRINT@650,"Enter the HIGH temperature for ";M$;" ";:FL=-3:GO
SUB2340:H(I)=VAL(IN$)
490 PRINT@714,"Enter the LOW temperature for  ";M$;" ";:FL=-3:GO
SUB2340:L(I)=VAL(IN$)
500 PRINT@778,"Enter the PRECIPITATION for    ";M$;" ";:FL=-5:GO
SUB2340:R(I)=VAL(IN$)
510 HT=H(I):LT=L(I):RF=R(I)
520 GOSUB2290:PUT1,PR:PR=PR+1:NN=NN+1:PRINT@640,ES$:NEXT
530 CLS:GOTO190
540 'UPDATE SPECIFIC RECORD
550 CLS:PRINT@0,TAB(32-LEN(RJ$(1))/2)RJ$(1):PRINT@64,TAB(32-LEN(
RJ$(2))/2)RJ$(2):PRINT@128,TAB(32-LEN(RJ$(8))/2)RJ$(8):PRINT@256
,LL$
560 PRINT@520,"<U>pdate record or <R>eturn to master menu ";:FL=
1:GOSUB2340
570 IF IN$="U"THEN580ELSE IF IN$="R"THEN190ELSE560
580 PRINT@456,EL$:PRINT@470,"Enter date  ";:GOSUB2180:M$=IN$:GOS
UB2120:DD=NN
590 ONERRORGOTO2540
600 RJ%=(DD-5478)
610 GET1,RJ%:QQ%=CVI(D$)
620 IFDD<>QQ%THEN630ELSE640
630 PRINT@720,"DATE ";M$;" DOES NOT EXIST":FORA=1TO1200:NEXTA:PR
INT@704,EL$:GOTO580
640 PRINT@384,ES$:PRINT@384,TAB(32-LEN(RJ$(9))/2)RJ$(9):PRINT@44
8,TAB(32-LEN(M$)/2)M$:GOSUB650:GOTO680
650 PRINT@591,"1. The HIGH temperature was ";USING P1$;CVI(HT$)
660 PRINT@655,"2. The LOW temperature was  ";USING P1$;CVI(LT$)
670 PRINT@719,"3. The PRECIPITATION was    ";USING P2$;CVS(RF$):
RETURN
680 PRINT@832,"Enter line # to be updated, <E>xit, <N>ext, <P>re
vious record ";:FL=1:GOSUB2340
690 ON INSTR("123ENP",IN$)GOTO710,720,740,190,760,770
700 GOTO680
710 PRINT@832,EL$:PRINT@847,"Enter new HIGH temperature  ";:FL=-
3:GOSUB2340:HT=VAL(IN$):LSET HT$=MKI$(HT):PUT1,RJ%:GOSUB650:GOTO
680
720 PRINT@832,EL$:PRINT@847,"Enter new LOW temperature   ";:FL=-
3:GOSUB2340
730 LT=VAL(IN$):LSETLT$=MKI$(LT):PUT1,RJ%:GOSUB650:GOTO680
740 PRINT@832,EL$:PRINT@847,"Enter the new PRECIPITATION ";:FL=-
5:GOSUB2340:RF=VAL(IN$):LSETRF$=MKS$(RF)
750 PUT1,RJ%:GOSUB650:GOTO680
760 RJ%=RJ%+1:GET1,RJ%:NN=CVI(D$):GOSUB2140:GOTO640
770 RJ%=RJ%-1:GET1,RJ%:NN=CVI(D$):GOSUB2140:GOTO640
780 'STATISTICS
790 DEFFNAA(HH,LL)=(HH+LL)/2
800 DEFFNAV(AA)=FIX((FIX(AA*10)+SGN(AA)*5)/10)
810 CLS:PRINT@0,TAB(32-LEN(RJ$(1))/2)RJ$(1):PRINT@64,TAB(32-LEN(
RJ$(2))/2)RJ$(2):PRINT@128,TAB(32-LEN(RJ$(10))/2)RJ$(10):PRINT@2
56,LL$
820 PRINT@520,"<C>alculations or <R>eturn to master menu ";:FL=1
:GOSUB2340
830 IFIN$="C"THEN     ELSE IFIN$="R"THEN190ELSE820
840 PRINT@512,ES$:PRINT@530,"Enter STARTING date ";:GOSUB2180:DA
$=IN$:M$=IN$:GOSUB2120:SD=NN:RS%=(SD-5478)
850 PRINT@658,"Enter ENDING date   ";:GOSUB2180:M$=IN$:GOSUB2120
:ED=NN:RE%=(ED-5478)
860 PRINT@512,ES$
870 GET1,RS%
880 IFSD=CVI(D$)THEN900ELSE890
890 PRINT@909,"STARTING DATE ";DA$;" DOES NOT EXIST ":FORBB=1TO1
200:NEXTBB:GOTO840
900 GET1,RE%
910 IFED<=CVI(D$)THENGOSUB2100:GOTO930ELSE920
920 PRINT@909,"ENDING DATE ";M$;" DOES NOT EXIST ":FORBB=1TO1200
:NEXTBB:GOTO840
```

Listing continues

Listing) records daily high and low temperatures, as well as precipitation. At any time the computer calculates the following statistics for any time period you specify: the average high and low temperatures, rounded to the nearest tenth of a degree; the average temperature for the period; the number of heating degree days; the period's highest and lowest temperatures and their dates; the number of days the high was 90 degrees or more, or 32 degrees or less; the number of days the low was 32 degrees or less; and the number it was zero degrees or less.

Pressing any key gives precipitation data in a form similar to the temperature statistics.

A homeowner can determine heating bills, or choose a type of insulation based on the degree-day information. People who heat with wood can get an idea of the necessary amount for the next heating season.

The Program

This program utilizes the NEWDOS80 2.0 operating system, and runs on a 32K one-drive system.

The calendar date routine is in lines 150 and 2110–2160. It converts the date you enter into an integer by the following steps:

- Line 170 reads the data elements in line 150 into the array MO(MO). The twelve elements in this array convert a date in the format MM/DD/YY into a signed integer.
- The date (MM/DD/YY) is broken into three variables: MO, DA, YR. The variable MO determines which of the 12

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Listing continued

```
930 RL=RS%
940 PRINT@512,TAB(32-LEN(RJ$(11))/2)RJ$(11):X=1
950 GET1,RL:GOSUB2100
960 NN=CVI(D$):GOSUB2140:PRINT@576,TAB(32-LEN(M$)/2)M$
970 NN(X)=D:H(X)=HT:L(X)=LT:R(X)=RF
980 IFCVI(D$)=EDTHEN1010ELSE RL=RL+1:X=X+1:GOTO950
990 ' DEGREE DAY CALCULATIONS
1000 Z=0:Q=0
1010 FORI=1TOX
1020 SS=FNAA(H(I),L(I))
1030 IFSS>=65THEN1060
1040 Z=65-FNAV(SS)
1050 Q=Q+Z
1060 NEXTI
1070 ' AVERAGE HIGH, AVERAGE LOW, AVERAGE TEMPERATURE CALCULATIO
NS
1080 FORI=1TOX
1090 A=A+H(I):B=B+L(I):NEXTI:C=A/X:E=B/X:F=(C+E)/2
1100 ' OUTPUT
1110 CLS:NN=SD:GOSUB2140:PRINT"        FROM  ";M$;:NN=ED:GOSUB214
0:PRINT"          TO          ";M$
1120 C(1)=C*10:C(2)=FIX(C(1)):IFABS(C(1))-C(2)>=.5THENC(2)=C(2)+
1
1130 C(3)=C(2)/10
1140 PRINT "The average HIGH was";C(3)
1150 E(1)=E*10:E(2)=FIX(E(1)):IFABS(E(1))-E(2)>=.5THENE(2)=E(2)+
1
1160 E(3)=E(2)/10
1170 PRINT "The average LOW was";E(3)
1180 F(1)=F*10:F(2)=FIX(F(1)):IFABS(F(1))-F(2)>=.5THENF(2)=F(2)+
1
1190 F(3)=F(2)/10
1200 PRINT "The AVERAGE temperature was";F(3)
1210 PRINT "Total DEGREE DAYS were";Q
1220 PRINT
1230 ' DETERMINING HIGHEST AND LOWEST TEMPERATURES
1240 L=-99999
1250 S=99999
1260 FOR I=1 TO X
1270 IF H(I)<=L THEN 1290
1280 L=H(I):DH=NN(I)
```

Listing continues

elements in MO(MO) are used in the calculation.

My starting date was 01/01/65. Your starting date is important because it determines where your date is placed on the disk. You must calculate your starting date and enter it into the program.

- Calculate an integer NN from those three variables by using the following formula:

NN = INT((YR*365.25 + .75) + MO(MO) + DA − 18263) − 2

For example: January 1, 1965—01/01/65 (my date)

Value = INT((65*365.25 + .75) + (−1) + 01 − 18263) − 2 = 5479

March 1, 1983—03/01/83

Value = INT((83*365.25 + .75) + 59 + 01 − 18263) − 2 = 12111

The number 59 in the last equation is derived from line 150 of the program listing (i.e., March is the third month of the year; therefore, count three data statements in).

Substituting the values from my date (01/01/65) results in the integer 5479. This value (NN − 1) is used in lines 600, 840, and 850. Your value will replace mine.

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Listing continued

```
1290 IF L(I)>=S THEN 1310
1300 S=L(I):DL=NN(I)
1310 NEXT I
1320 FOR I=1 TO X
1330 IF H(I)=L THEN 1350
1340 NEXT I
1350 I1=I
1360 FOR I=1 TO X
1370 IF L(I)=S THEN 1390
1380 NEXT I
1390 I2=I
1400 NN=DH:GOSUB2140:PRINT "The HIGHEST temperature was ";L;"on
";M$
1410 NN=DL:GOSUB2140:PRINT "The LOWEST temperature was ";S;"on "
;M$
1420 ' DETERMINING # OF DAYS TEMPERATURE FALLS WITHIN CERTAIN RA
NGES
1430 PRINT
1440 W=0:V=0:K=0:M=0
1450 FOR I=1 TO X
1460 IF H(I)>=90 THEN 1480
1470 GOTO 1490
1480 W=W+1
1490 IF H(I)<=32 THEN 1510
1500 GOTO 1520
1510 V=V+1
1520 NEXT I
1530 FOR I=1 TO X
1540 IF L(I)<=0 THEN 1560
1550 GOTO 1570
1560 K=K+1
1570 IF L(I)<=32 THEN 1590
1580 GOTO 1600
1590 M=M+1
1600 NEXT I
1610 P=((M)/X)*100
1620 PRINT "# of days HIGH 90 or +:";W;"      ";P;"% of days had
"
1630 PRINT "# of days HIGH 32 or -:";V;"          ";"temp. at or
 below freezing"
1640 PRINT "# of days LOW 32 or -:";M
1650 PRINT "# of days LOW 0 or -:";K
1660 PRINT@916,"PRESS ANY KEY TO CONTINUE"
1670 A$=INKEY$:IFA$=""THEN1670
1680 CLS
1690 ' PRECIPITATION CALCULATIONS
1700 PRINT@530,"WORKING ON PRECIPITATION DATA"
1710 SS=0:A=0:B=0:C=0
1720 FOR I=1TOX
1730 SS=SS+R(I)
1740 IFR(I)>=.10 THEN 1760
1750 GOTO 1770
1760 A=A+1
1770 IF R(I)>=.50 THEN 1790
1780 GOTO1800
1790 B=B+1
1800 IF R(I)>=1.00 THEN 1820
1810 GOTO 1830
1820 C=C+1
1830 NEXTI
1840 L=0
1850 FOR I=1TOX
1860 IFR(I)>LTHENL=R(I):DR=NN(I)
1870 NEXTI
1880 CLS
1890 PRINT@147,"P R E C I P I T A T I O N"
1900 PRINT@211,"- - - - - - - - - - - - - -"
1910 PRINT
1920 PRINTTAB(11)"Total Precipitation was  ";USING P2$;SS;:PRINT
"  inches."
1930 PRINT
1940 NN=DR:GOSUB2140:PRINT"    The greatest amount of rainfall w
as ";USING P2$;L;:PRINT"  on ";M$
1950 PRINT:PRINTTAB(10)"The number of days of 1.00 or more were
 ";C
1960 PRINTTAB(10)"The number of days of  .50 or more were  ";B
1970 PRINTTAB(10)"The number of days of  .10 or more were  ";A
1980 PRINT:PRINT
1990 CLOSE
2000 GOTO2000
2010 CLOSE:END
2020 'STRINGS
2030 RJ$(1)="    WEATHER   STATISTICS    ":RJ$(2)="WRITTEN BY BI
LL BUNCH":RJ$(3)="MASTER MENU":RJ$(4)="SUB MENU   ":RJ$(5)="Ente
r your selection":RJ$(6)="LAST DATE ENTERED":RJ$(7)="RECORD INPU
T PROGRAM"
2040 RJ$(8)="RECORD UPDATE PROGRAM":RJ$(9)="DATE TO BE UPDATED"
2050 RJ$(10)="STATISTICS CALCULATIONS":RJ$(11)="WORKING ON DATE"
```

Listing continues

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If this value is not changed, when you run the program and access a date error code 60 (bad record) causes the program to terminate. ■

William Bunch can be reached at 51 Fairwood Drive, Cranston, RI 02920.

Robert J. Lisi can be reached at 100 Meadow Road, North Providence, RI 02904.

A	High temperature accumulator
AA	Average temperature function
AV	Rounding function
B	Low temperature accumulator
B1	String variable
BB	A counter
C	Average high temperature
CF	Used in blinking cursor routine
CO	Same as above
D	Used as date
DA	String variable (Input-Date)
DD	Date
DH	Date of high temperature
DL	Date of low temperature
DR	Date of greatest precipitation
E	Average low temperature
ED	Ending date
EL	String variable to erase to end of line
EN	LOF (1)
ES	String variable to erase to end of screen
F	Average temperature
FL	Field length in blinking cursor
H	High temperature
HT	High temperature of disk
I	Counter
I1	Accumulator
I2	Accumulator
IN	String input
K	Number of days low zero or –
L	Low temperature
LT	Low temperature from disk
M	Date
MO	Month data
N	Counter
NN	Date integer
P	Percentage of days at or below 32 degrees
P1	Print using string
P2	Same as above
PR	Physical record
Q	Degree day accumulator
QQ	Date integer
R	Rainfall
RE	Last record on disk file
RF	Rainfall of disk
RL	Record number
RS	First record on file
SD	Starting date
T	Calendar conversion routine
V	Number of days high 32 or –
W	Number of days high 90 or +
X	Counter
YR	Year
Z	Degree days

Fig. 1. List of Variables

Listing continued

```
2060 B1$=CHR$(8):B$=STRING$(32,B1$):EL$=CHR$(30):ES$=CHR$(31):CO
$=CHR$(15)
2070 P1$="###":P2$="##.##"
2080 RETURN
2090 ' DISK FILE ORGANIZATION
2100 D=CVI(D$):HT=CVI(HT$):LT=CVI(LT$):RF=CVS(RF$):RETURN
2110 ' CALENDAR CONVERSION ROUTINES
2120 YR=VAL(RIGHT$(M$,2)):MO=VAL(LEFT$(M$,2)):DA=VAL(MID$(M$,4))
:NN=INT(YR*365.25+.75)+MO(MO)+DA-18263
2130 IF YR-(INT(YR/4)*4 )<>0 AND MO>2THEN NN=NN-1:RETURN
2140 T1=NN+18263:YR=INT(T1/365.25):DA=INT(T1-YR*365.25):MO=12:IF
 YR-(INT(YR/4)*4)<>0 AND DA>58 THEN DA=DA+1
2150 IFDA<=MO(MO)THENMO=MO-1:GOTO2150ELSEDA=DA-MO(MO)
2160 M$=RIGHT$(STR$(MO),2)+"/"+RIGHT$(STR$(DA),2)+"/"+RIGHT$(STR
$(YR),2):RETURN
2170 ' ROUTINE TO ASSURE DATE ENTERED IN MM/DD/YY FORMAT
2180 FL=8:GOSUB2340
2190 IFINSTR(1,IN$,"/")<>3ANDINSTR(4,IN$,"/")<>6THEN2240
2200 J1=VAL(MID$(IN$,1,2)):IFJ1<1ORJ1>12THEN2240
2210 J2=VAL(MID$(IN$,4,2)):IFJ2<1ORJ2>31THEN2240
2220 J3=VAL(MID$(IN$,7,2)):IFJ3<65THEN2240
2230 M$=IN$:RETURN
2240 PRINTMID$(B$,1,8);:GOTO2180
2250 RETURN
2260 ' DISK FILE
2270 OPEN"R",1,"TEMP/DAT",10:RETURN
2280 FIELD 1,2ASD$,2ASHT$,2ASLT$,4ASRF$:RETURN
2290 LSETD$=MKI$(D):LSETHT$=MKI$(HT):LSETLT$=MKI$(LT):LSETRF$=MK
S$(RF):RETURN
2310 CLS:PRINT@522,"Enter STARTING date  ";:GOSUB2180
2320 DD=NN:DA$=M$:GOTO450
2330 ' FLASHING CURSOR ROUTINE
2340 IN$="":CF=0:W$=INKEY$:WD=0:WS=WD:WL=WD:IFFL=WDTHENFL=1
2350 PRINTSTRING$(ABS(FL),CHR$(136));STRING$(ABS(FL),CHR$(24));
2360 PRINTCHR$(14);:FORW=1TO25:W$=INKEY$:IFW$<>""THEN2370ELSENEX
T:PRINTCHR$(15);:FORW=1TO25:W$=INKEY$:IFW$<>""THEN2370ELSENEXT:G
OTO2360
2370 IFW$<>CHR$(13)THEN2390ELSE PRINTSTRING$(ABS(FL)-WL," ");
2380 PRINTCHR$(15);:W=25:NEXT:RETURN
2390 IFW$<>"@"THEN2410
2400 CF=1:PRINTCHR$(15);:RETURN
2410 PRINTCHR$(14);:IFW$=CHR$(24)THEN PRINTSTRING$(WL,CHR$(24));
:GOTO2340
2420 IFW$<>CHR$(8)THEN2460ELSEIFWL=0THEN2360ELSEPRINTCHR$(24);:I
FFL>0THEN2440ELSEIFPEEK(16418)=44THEN2450
2430 IFPEEK(16418)=46THENWD=0:GOTO2440 ELSEIFPEEK(16418)=43ORPEE
K(16418)=45THENWS=0
2440 IN$=LEFT$(IN$,LEN(IN$)-1)
2450 WL=WL-1:POKE16418,136:GOTO2360
2460 IFABS(FL)=WLTHEN2360 ELSEIFFL>0THENIFW$>=" "ANDW$<="Z"THEN2
510
2470 IFW$="."ANDWD=0THENWD=1:GOTO2510
2480 IFW$=","THENPRINTW$;:WL=WL+1:GOTO2520
2490 IF(W$="-"ORW$="+")ANDWS=0ANDWL=0THENWS=1:GOTO2510
2500 IFW$<"0"ORW$>"9"THEN2360
2510 PRINTW$;:IN$=IN$+W$:WL=WL+1
2520 IFABS(FL)=1THEN2380 ELSE 2360
2530 ' ERROR CODE OUTPUT
2540 CLS
2550 '
2560 CLS:PRINT@512,"BASIC ERROR CODE ";ERR/2+1;" HAS OCCURRED IN
 LINE # ";ERL
2570 PRINT:PRINT"PLEASE CONSULT 'NEWDOS/80 MANUAL' FOR DETAILS":
PRINT"PRESS ENTER TO RESUME ";
2580 FL=1:GOSUB2340:IFIN$<>CHR$(13)THEN2560ELSERESUME190
```

Model II/12/16 Conversion

CONVERSION BY Robert J. Lisi

DELETE THE FOLLOWING LINES:

2480-2520

ADD THE FOLLOWING LINES:

```
2025 RJ$(1)="*** WEATHER   STATISTICS ***":RJ$(2)="Written By: BILL BUNCH & ROBE
RT J. LISI":RJ$(3)="MASTER MENU":RJ$(4)="SUB MENU    ":RJ$(5)="> Enter your selec
tion: ":RJ$(6)="LAST DATE ENTERED":RJ$(7)="RECORD INPUT PROGRAM"
2035 RJ$(10)="STATISTICS CALCULATIONS":RJ$(11)="WORKING ON DATE"
2045 LS$=STRING$(79,"-"):LE$=STRING$(79,"="):P1$="######":P2$="####.##"
2055 S$=STRING$(32,32):R$=CHR$(26):N$=CHR$(25):CF$=CHR$(2):CO$=CHR$(1)
2065 LL$=STRING$(79,"_"):OF$=CHR$(2)
2345 WE=1:IN$=MID$(S$,1,ABS(FL)):MID$(IN$,1,LEN(ED$))=ED$
2355 W=1:PRINTCF$;W1$;IN$;MID$(B$,1,ABS(FL));CO$;
2365 IFW$=CHR$(16)THENWB=USR7(0):GOTO2360
2375 IFW$=CHR$(29)THENIFW<=ABS(FL)THENPRINTMID$(IN$,W,1);:W=W+1:GOTO2430
2385 IFW$=CHR$(4)THENIFW<=ABS(FL)THENMID$(IN$,W,ABS(FL)-W)=MID$(IN$,W+1,ABS(FL)-
```

Conversion continues

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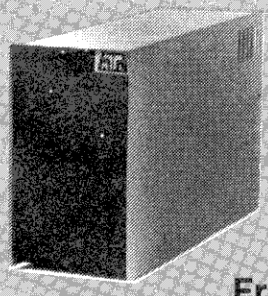

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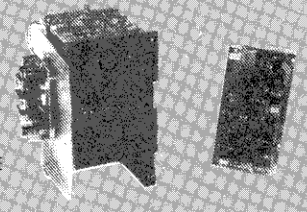

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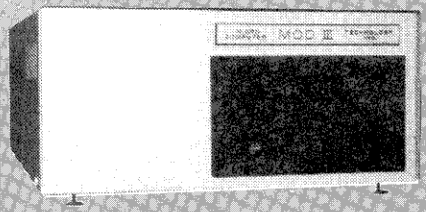

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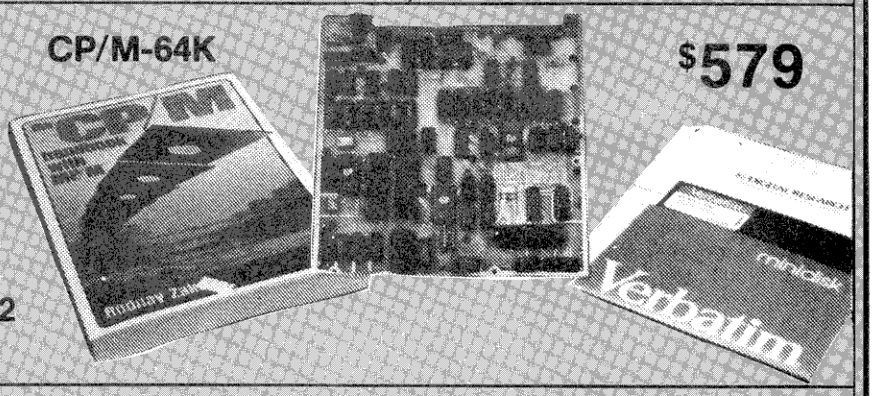

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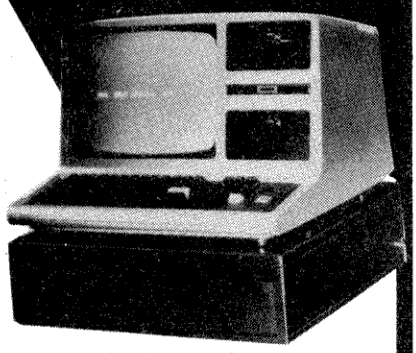

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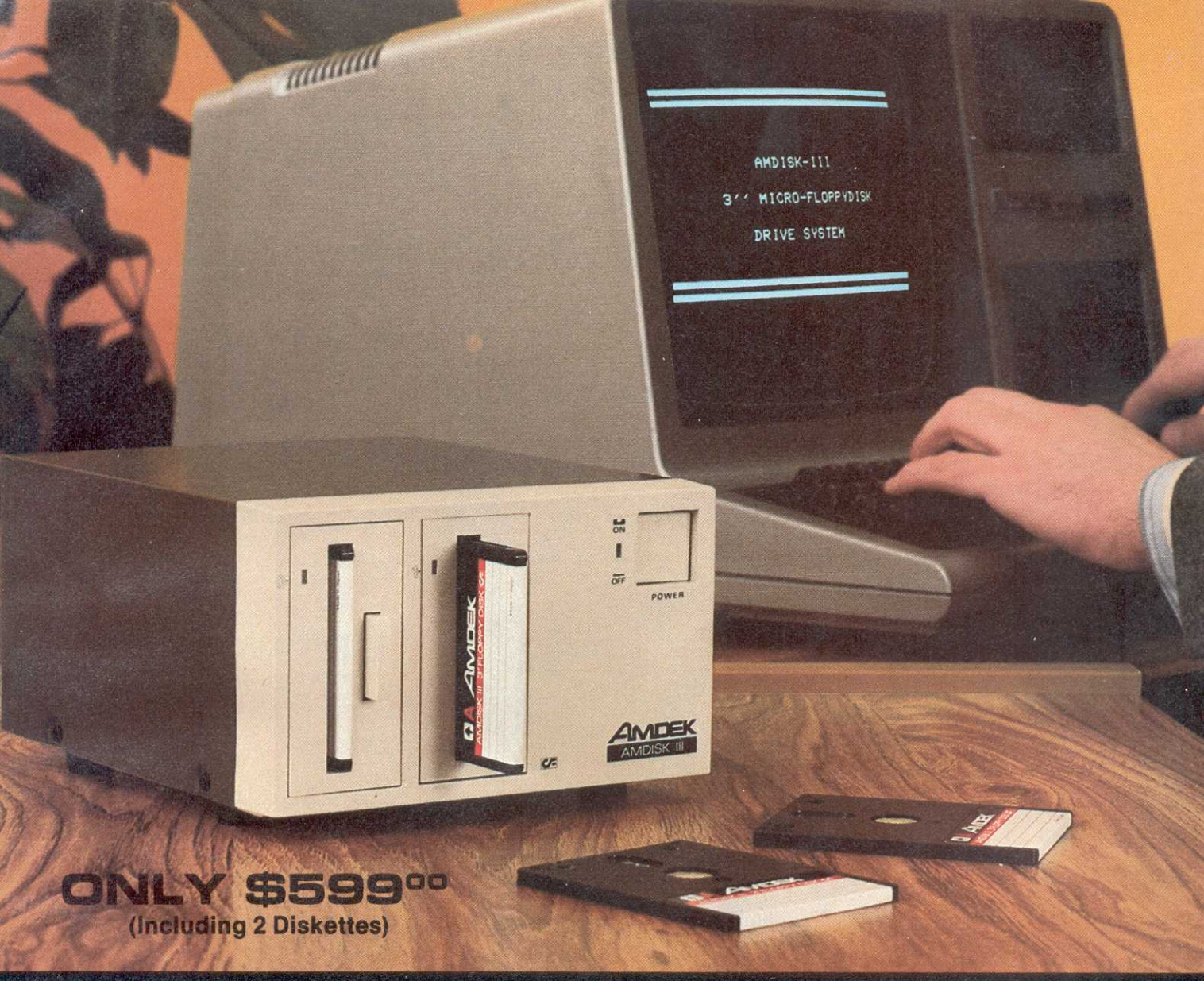
Conversion continued

```
W):MID$(IN$,ABS(FL),1)=" ":GOTO2435
2395 IFW=1THEN2410ELSEIFW$=CHR$(8)THENPRINTW$;FL$;B1$;:W=W-1:MID$(IN$,W,1)=FL$:G
OTO2360
2405 IFW$=CHR$(28)THENPRINTW$;:W=W-1:GOTO2360
2415 IFCF=0ANDW=1THENCF=5
2425 MID$(IN$,W,1)=W$:W=W+1:PRINTW$;
2435 PRINTCF$;MID$(B$,1,W-1);IN$;MID$(B$,1,ABS(FL)-W+1);CO$;:GOTO2360
2445 GOSUB2345
2455 IN#=VAL(IN$):RETURN
2465 PRINTMID$(B$,1,ABS(FL));:ONWE+1GOTO2440,2445
2475 PRINTMID$(B$,1,ABS(FL));:ONWE+1GOTO2440,2445

EDIT THE FOLLOWING LINES:

160 PRINT@(12,25),"OPENING DATA FILES .....";:PRINTCHR$(2)
190 CLS:PRINT@(1,25),FNRV$("*** WEATHER STATISTICS ***"):PRINT@(3,0),TAB(40-LEN(
RJ$(2))/2)RJ$(2)
200 PRINT@(5,0),TAB(40-LEN(RJ$(3))/2)RJ$(3):PRINTLL$
210 PRINT@(8,5),"<U>pdate specific date";TAB(50)"<A>dd data"
220 PRINT@(10,5),"<I>nitialize new data file";TAB(50)"<S>tatistics report"
230 PRINT@(12,28),"<E>nd session":PRINTLL$
240 PRINT@(20,0),TAB(32-LEN(RJ$(5))/2)RJ$(5);
260 ON INSTR("IAUSE",IN$)GOTO 280,370,540,780,2590
300 CLS:PRINT@(1,25),FNRV$("**** W A R N I N G ****"):PRINT@(3,15),"THIS PROGRAM
 WILL ";FNRV$("DESTROY");" ALL PRESENT DATA !!!"
310 PRINT@(5,20),"Do you wish to continue (Y/N)";:FL=1:GOSUB2340
340 PRINT@(8,28),"SURE (Y/N) ";:FL=1:GOSUB2340
360 PRINT@(18,20),"KILLING TEMP/DAT FILE":CLOSE:KILL"TEMP/DAT":GOTO190
380 CLS:PRINT@(1,25),FNRV$("*** WEATHER STATISTICS ***"):PRINT@(3,0),TAB(40-LEN(
RJ$(2))/2)RJ$(2):PRINT@(5,0),TAB(40-LEN(RJ$(7))/2)RJ$(7):PRINTLL$
390 PRINT@(12,20),"<I>nput new days or <R>eturn to master menu ";:FL=1:GOSUB2340
430 PRINT@(8,0),ES$;:PRINT@(8,0),TAB(40-LEN(RJ$(6))/2)RJ$(6)
440 PRINT@(10,0),TAB(40-LEN(M$)/2)M$:NN=NN+1
450 PRINT@(14,15),"How many days will be entered ";:FL=3:GOSUB2440:IFCF=1THEN190
ELSEN=VAL(IN$):PRINT@650,EL$:M$=DA$
460 FOR I=1TON:PRINT@(14,0),ES$;
480 PRINT@(14,15),"Enter the HIGH temperature for ";M$;" ";:FL=3:GOSUB2440:IFCF=
1THEN190ELSEH(I)=VAL(IN$)
490 PRINT@(15,15),"Enter the LOW temperature for  ";M$;" ";:FL=3:GOSUB2440:IFCF=
1THEN190 ELSE L(I)=VAL(IN$)
500 PRINT@(16,15),"Enter the PRECIPITATION for    ";M$;" ";:FL=5:GOSUB2440:IFCF=
1THEN190 ELSE R(I)=VAL(IN$)
550 CLS:PRINT@(1,25),FNRV$("*** WEATHER STATISTICS ***"):PRINT@(3,0),TAB(40-LEN(
RJ$(2))/2)RJ$(2):PRINT@(5,0),TAB(40-LEN(RJ$(8))/2)RJ$(8):PRINTLL$
560 PRINT@(10,20),"<U>pdate record or <R>eturn to master menu ";:FL=1:GOSUB2340
580 PRINT@(8,0),ES$;:PRINT@(12,20),"Enter date  ";:GOSUB2180:M$=IN$:GOSUB2120:DD
=NN
630 PRINT@(8,25),FNRV$("DATE ");M$;" DOES NOT EXIST":FORA=1TO1200:NEXTA:PRINT@(8
,0),ES$;:GOTO580
640 PRINT@(6,0),ES$;:PRINT@(5,0),TAB(40-LEN(RJ$(9))/2)RJ$(9):PRINT@(6,0),TAB(40-
LEN(M$)/2)M$:PRINTLL$:GOSUB650:GOTO680
650 PRINT@(10,15),"1. The HIGH temperature was ";USING P1$;CVI(HT$)
660 PRINT@(11,15),"2. The LOW temperature was  ";USING P1$;CVI(LT$)
670 PRINT@(12,15),"3. The PRECIPITATION was    ";USING P2$;CVS(RF$):RETURN
680 PRINT@(20,10),"Enter line # to be updated, <E>xit, <N>ext, <P>revious record
 ";:FL=1:GOSUB2340
710 PRINT@(20,0),EL$;:PRINT@(20,20),"Enter new HIGH temperature  ";:FL=-3:GOSUB2
340:HT=VAL(IN$):LSET HT$=MKI$(HT):PUT1,RJ%:GOSUB650:GOTO680
720 PRINT@(20,0),EL$;:PRINT@(20,20),"Enter new LOW temperature   ";:FL=-3:GOSUB2
340
740 PRINT@(20,20),EL$;:PRINT@(20,20),"Enter the new PRECIPITATION ";:FL=-5:GOSUB
2340:RF=VAL(IN$):LSETRF$=MKS$(RF)
810 CLS:PRINT@(1,18),FNRV$("*** WEATHER STATISTICS CALCULATIONS ***"):PRINT@(3,0
),TAB(40-LEN(RJ$(2))/2)RJ$(2):PRINT@(5,0),TAB(40-LEN(RJ$(10))/2)RJ$(10):PRINTLL$
820 PRINT@(10,20),"<C>alculations or <R>eturn to master menu ";:FL=1:GOSUB2340
830 IFIN$="C"THEN 840 ELSE IFIN$="R"THEN190ELSE820
840 PRINT@(7,20),ES$;:PRINT@(10,25),"Enter STARTING date ";:GOSUB2180:DA$=IN$:M$
=IN$:GOSUB2120:SD=NN:RS%=(SD-5478)
850 PRINT@(12,25),"Enter ENDING date   ";:GOSUB2180:M$=IN$:GOSUB2120:ED=NN:RE%=(
ED-5478)
860 PRINT@(7,0),ES$;
890 PRINT@(20,20),"STARTING DATE ";CHR$(26);DA$;CH$(25);" DOES NOT EXIST ":FORBB
=1TO1200:NEXTBB:GOTO840
920 PRINT@(20,20),"ENDING DATE ";CHR$(26);M$;CHR$(25);" DOES NOT EXIST ":FORBB=1
TO1200:NEXTBB:GOTO840
940 PRINT@(5,0),TAB(40-LEN(RJ$(11))/2)RJ$(11):X=1
960 NN=CVI(D$):GOSUB2140:PRINT@(7,0),TAB(40-LEN(M$)/2)M$
1660 PRINT@(20,25),FNRV$("PRESS ANY KEY TO CONTINUE");:PRINTCHR$(2)
1700 PRINT@(7,0),EL$;:PRINT@(7,25),"WORKING ON PRECIPITATION DATA"
1890 PRINT@(3,25),"P R E C I P I T A T I O N"
1900 PRINT@(4,25),"- - - - - - - - - - - - -"
1990 REM
2000 PRINT@(20,20),FNRV$("PRESS ENTER TO RETURN TO MENU");:PRINTCHR$(2)
2010 A$=INKEY$:IFA$=CHR$(13)THEN190ELSE2010
2030 RJ$(8)="RECORD UPDATE PROGRAM":RJ$(9)="DATE TO BE UPDATED"
2040 DEFFNRV$(X$)=R$+" "+X$+N$+CHR$(158)
2050 B1$=CHR$(28):B$=STRING$(32,B1$):FL$="_":F$=STRING$(32,FL$)
2060 EL$=CHR$(23):ES$=CHR$(24):DG$=".0123456789":CC$=CO$+CF$+CHR$(30)+CHR$(31)
2310 PRINT@(8,0),ES$;:PRINT@(10,20),"Enter STARTING date  ";:GOSUB2180:GOSUB2120
2340 FORK5=1TO8:X$=INKEY$:NEXT:IN$=MID$(F$,1,ABS(FL)):WE=0:GOTO2350
2350 CF=0:W1$=R$:IFFL>0THENW1$=N$
2360 W$=INKEY$:IFW$=""THEN2360
2370 IFW>ABS(FL)THEN2390ELSEIFW$>=" "ANDW$<="~"THEN2425
2380 IFW$=CHR$(9)THENIFW<=ABS(FL)THENMID$(IN$,W+1,ABS(FL)-W)=MID$(IN$,W,ABS(FL)-
W):MID$(IN$,W,1)=" ":GOTO2435
2390 CF=INSTR(CC$,W$):IFCF<>0THENW$=CHR$(13):GOTO2410
2400 IFW$=CHR$(27)THENPRINTMID$(B$,1,W-1);:ONWE+1GOTO2340,2345
2410 IFW$<>CHR$(13)THEN2360ELSEIFWE=0THENIN$=MID$(IN$,1,W-1)
2420 PRINTCF$;MID$(B$,1,W-1);N$;IN$;SPC(ABS(FL)-LEN(IN$));:RETURN
2430 IFABS(FL)=1THENW$=CHR$(13):GOTO2410ELSE2360
2440 GOSUB2340:GOTO2450
2450 IFCF<>0THEN2455ELSEFORW=1TOLEN(IN$):IF0=INSTR(DG$,MID$(IN$,W,1))THENW=LEN(I
N$):NEXT:GOTO2465:ELSE NEXT
2460 IFCF<>0THEN2470THEN2475ELSEFORW=1TOLEN(IN$):IF0=INSTR(DG$,MID$(IN$,W,1))THE
NW=LEN(IN$):NEXT:GOTO2475ELSENEXT
2470 IN#=VAL(IN$):RETURN
2540 IF ERR=60 THEN PRINT@(20,0),ES$;:PRINT@(21,20),"DATE "CHR$(26);M$;CHR$(25);
" DOES NOT EXIST";:PRINTCHR$(2):FORAA=1TO900:NEXTAA:RESUME 190
2560 CLS:PRINT@(12,10),"BASIC ERROR CODE ";ERR;" HAS OCCURRED IN LINE # ";ERL
2570 PRINT:PRINT"PLEASE CONSULT ' "FNRV$("BASIC OWNERS MANUAL")" ' FOR DETAILS":
PRINT"PRESS ENTER TO RESUME ";
```



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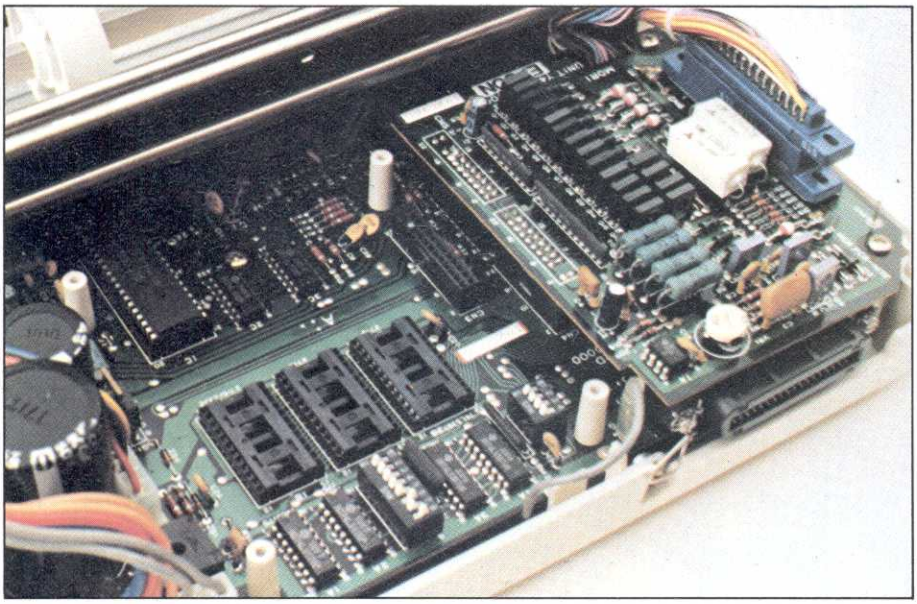

Photo 1. Connector inside the MX-80. Note that one pin is blocked to assure that auxiliary interface boards will be inserted correctly. Empty sockets are for Graftrax ROMs.

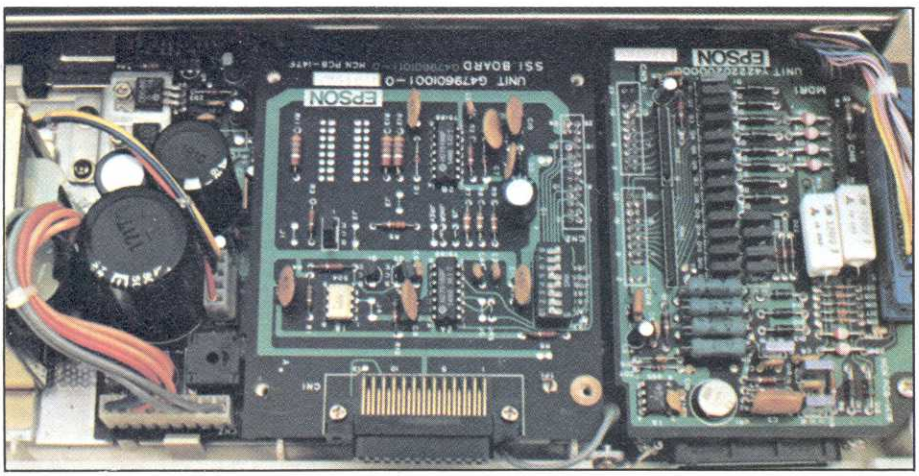

Photo 2. Epson 8141 Serial Interface Board. This board does not support dot-addressable graphics on Graftrax-80, and it is completely incompatible with Graftrax-Plus.

Here's an inexpensive serial interface circuit for the Epson MX-80 and the Color Computer.

It must be a corollary to Murphy's law that compatible pieces of equipment are never compatible. At least, that's what I found when I bought an Epson MX-80 printer to use with my Color Computer.

I had problems interfacing the equipment because the MX-80's Graftrax option doesn't support graphics with Epson's least expensive serial interface board (Model 8141).

In this article I'll present an inexpensive serial interface circuit that supports all MX-80 modes, including dot-addressable graphics. I've also included two programs that dump Color Computer graphics screens (PMODEs 3 or 4) to the MX-80.

Serial Interfaces

A computer (or a printer's microprocessor) sends or receives data in two ways. These are:

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16K RAM
Extended Color Basic
Epson MX-80

- Serially, sending and receiving information through a 1-bit port while software deciphers the characters, and
- In parallel, using byte-wide (8-bit) ports to and from a device that independently sends or receives serial data.

If you can spare the microprocessor time, using software to send data saves output port space (1 bit versus 8 bits). You also need no other devices to translate incoming parallel data to the serial protocol (except to convert to the RS-232 voltage levels).

The MX-80 with the 8141 board uses the software mode. Its microprocessor cannot translate data from the serial input and simultaneously handle the printer's other functions.

Four classes of boards (I'll call them board types 1–4) interface serially with the MX-80. In order of increasing complexity, these are:

- A simple home-brewed board translating transistor–transistor logic (TTL)/RS-232 voltage levels only. See Fig. 1.
- Epson's Model 8141 board, which also includes the rarely-needed teletypewriter (TTY) interfacing compatibility.
- A home-brewed board incorporating a UART (universal asynchronous receiver/transmitter) to convert from serial to parallel. See Fig. 2.
- A single-board microcomputer such as the Epson 8150 that converts from serial to parallel and also buffers the incoming data.

Only board types 3 and 4 support dot-addressable graphics on the MX-80 with Graftrax-80 or Graftrax-Plus. Types 1 and 2 don't work with Graftrax-Plus.

The rest of this article describes how to build and use board type 3. (While only the more complicated board 3 is referred to, the construction technique is similar for board type 1.) These serial interface boards let you access all MX-80 capabilities, including dot-addressable graphics.

The Basics

These boards are built around a UART chip. UART chips have two independent channels. One converts from serial to parallel, the other from parallel to serial. The two channels have common parity, but their baud rates can differ.

The circuit for a type 3 board, shown in Fig. 2, emulates a Centronics-type parallel interface. It is plugged into a connector in parallel with the external Centronics-type printer connector. The major difference is that the internal connector also has power supply leads.

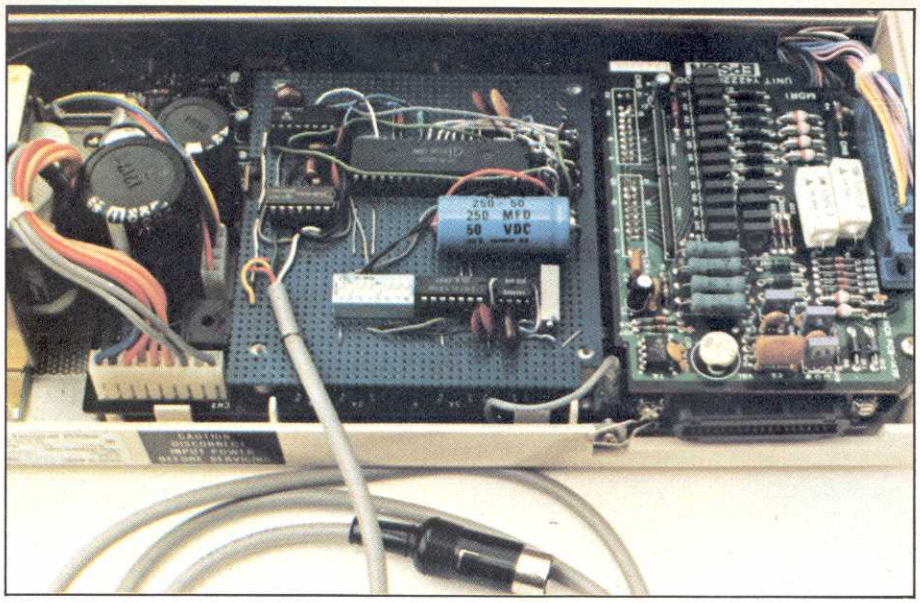
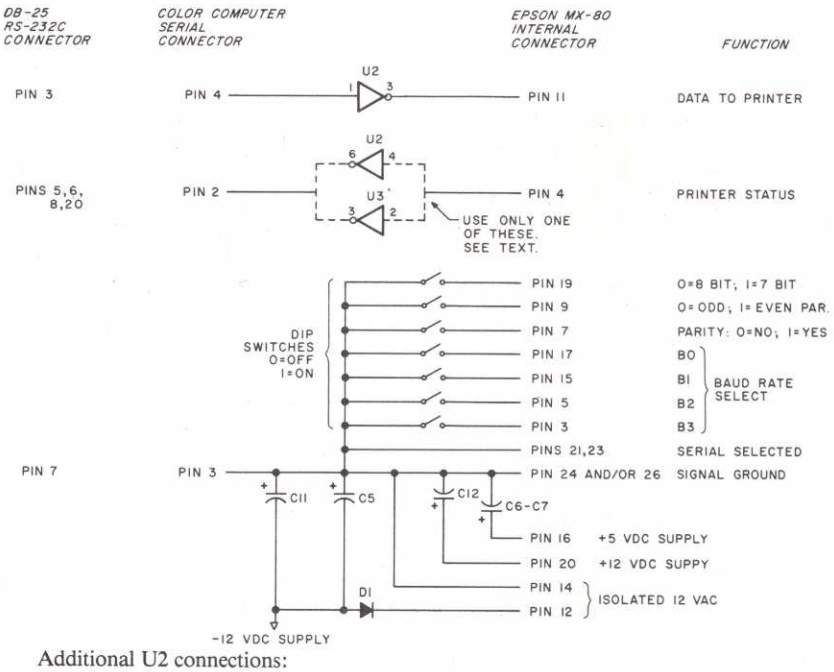


Photo 3. Prototype Board for the Circuit in Fig. 2



Additional U2 connections:
To ground: Pins 4, 7, 10, 13 (if not used)
To +5V dc: Pin 14
Additional U3 connections (if used):
To ground: Pin 7
To +12V dc: Pin 14
To −12V dc: Pin 1
Baud rate select: (B3–B2–B1–B0):

1111 = 75 Baud	1100 = 150 Baud	1001 = 600 Baud	0110 = 2400 Baud
1110 = 110 Baud	1011 = 200 Baud	1000 = 1200 Baud	0101 = 4800 Baud
1101 = 134.5 Baud	1010 = 300 Baud	0111 = 1800 Baud	0100 = 9600 Baud

Fig. 1. Circuit Diagram for Type 1 Board

The board type 3 circuit has four main sections: the power supply, the TTL/RS-232 voltage level converters, the UART and handshaking circuits, and the circuits associated with choosing baud rates. The data received serially is converted to normal TTL levels. The UART, using the parameters set by the DIP (dual in-line package) switches, presents the printer with eight lines of data (all of which may not be in use) latched into the printer using two handshake signals.

One of the printer's status lines (pin 4 in the internal printer connector) is channeled to pin 4 of the Color Com-

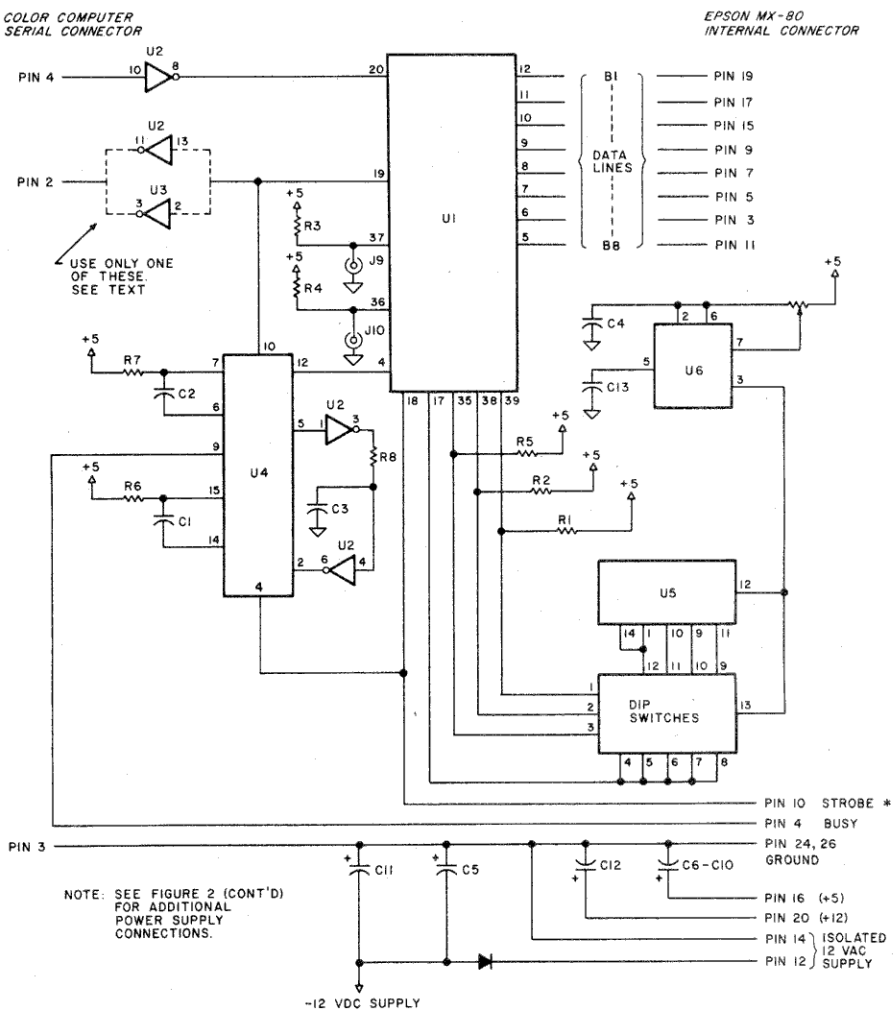
puter's serial connector. The printer's two other status lines, Error and Out of Paper, are not used in this configuration because if either is on, the first printer status line also reads busy.

You could use board type 3 with the parallel connector of any printer, an external power supply, and a matching connector. I intended to build an internal board powered by the internal MX-80 connector but also connected to the Centronics-type connector on the back of the printer. Then I discovered that all the required data lines were available from the internal connector. You can explore these alternative connections.

Construction

You can assemble the circuit for a type 3 board on a fixed-pattern perforated circuit board (perfboard) using soldered jumpers (as I did on my prototype) or you can use a printed circuit (PC) board. There is no room inside the printer for the long socket pins used in wire-wrapping unless you raise the board. You should use sockets for all ICs, but solder all other components, including the DIP switches, in place.

I use the GC Electronics positive



Additional U1 connections:
To +5V dc: Pin 1
To ground: Pins 3, 16, 21, 23, 26 to 33, 40
No connection: Pins 13, 14, 15, 22, 24, 25
Additional U2 connections:
To +5V dc: Pins 14, 13 (if not used as line driver)
To ground: Pin 7
Additional U3 connections (if U3 is used):
To +12V dc: Pin 14
To −12V dc: Pin 1
To ground: Pin 7
No connection: Pins 4, 5, 6, 8, 9, 10, 11, 12, 13
Additional U4 connections:
To +5V dc: Pins 3, 11, 16
To ground: Pins 1, 8
Additional U5 connections:
To +5V dc: Pins 4, 5, 6, 7
To ground: Pins 2, 3, 10
Additional U6 connections:
To +5V dc: Pins 4, 8
To ground: Pin 1
Additional DIP switch connections:
To ground: Pins 14, 15, 16
J9* should be inserted only if your system uses 5 or 6 bits per character rather than 7 or 8.
J10* should be inserted only if your system uses only 1 stop bit instead of 2.

*These jumpers are not used with the Color Computer.

Fig. 2. Circuit Diagram for Type 3 Board

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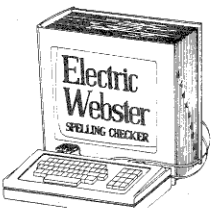

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You can assemble an internal board very easily on any perfboard. The internal connection to the printer is the only tricky part. I'll explain how to use one of these connectors with a perfboard later. In any case, use a long cable with a terminal connector matching your computer's. See Fig. 1.

Photo 1 shows the connector and the space where an optional interface board plugs into the MX-80. Photo 2 shows the now-obsolete Epson 8141 board I used previously in the printer. Photo 3 shows the handwired prototype board now in my printer.

Figure 3 contains the printed circuit pattern for my board, while Fig. 4 shows component and jumper placement on the board. Table 1 lists the parts for a type 3 board.

Because the RS-232 signals are relatively slow for a digital system, component layout is not critical. Capacitors C1–C4 are used in timing circuits. They should not be disc capacitors: Use the more stable polystyrene or mica capacitors.

When the board is finished, make sure that potentiometer R1 yields a frequency from the 555 chip (U6) of exactly 16 times your maximum transfer rate. Since 4800 baud (POKE 150,6 or POKE 150,7 in the Color Computer) is my highest rate, I adjusted the output of the 555 chip to exactly 76,800 Hz. If you are planning to use 9600 baud, halve the size of capacitor C4 and adjust R9 to obtain a frequency of 153,600 Hz.

If you use a disc capacitor for C4 with the 555, the frequency may be unstable, and produce annoying and unpredictable errors. As with any resistor-capacitor timing circuit, it may require recalibration after the capacitor burns in.

The most difficult part of putting the board together is soldering the board-to-board connector. The female connector in the printer has 26 pins, but the male connector on your board can have either 24 or 26 pins since pins 1 and 2 are not used for this project. You must also cut or remove from the connector several other pins that are not used (specifically, pins 6, 8, 13, 18, and 22).

Table 2 shows the pin designation for the internal printer connector, cross-referenced to the connections on the external parallel connector. Note that many pins on the internal connector have different functions depending on whether the data going into the printer connector is in bit-by-bit (serial) or parallel mode. (Remember that board types 1 and 2 feed the printer serial data

Part	Description
C1–C2	100 pF mica capacitors
C3	220 pF mica capacitor
C4	510 pF mica capacitor
C5	220 μF electrolytic capacitor (35V)
C6–C13	0.1 μF disc-type capacitors
D1	1N–4001 power diode
R1–R5	5k ¼-watt resistors
R6	10k ¼-watt resistor
R7	33k ¼-watt resistor
R8	2.2k ¼-watt resistor
R9	20k 15-turn potentiometer
U1	AY-5-1015 (Radio Shack part no. 276–1794)
U2	1489 RS-232 receiver
U3	1488 RS-232 driver
U4	74LS123 dual one-shot
U5	74LS93 4-bit counter
U6	555 timer
	Circuit board
	8-section DIP switch
	24- or 26-pin board-to-board connector such as part no. 929836-05 from Digi-Key, P.O. Box 677, Thief River Falls, MN 56701
	RS-232 or DIN connector with cable
	Sockets for all integrated circuits

Note: See Fig. 1 for parts necessary for type 1 boards.

Table 1. Parts List for Board Type 3

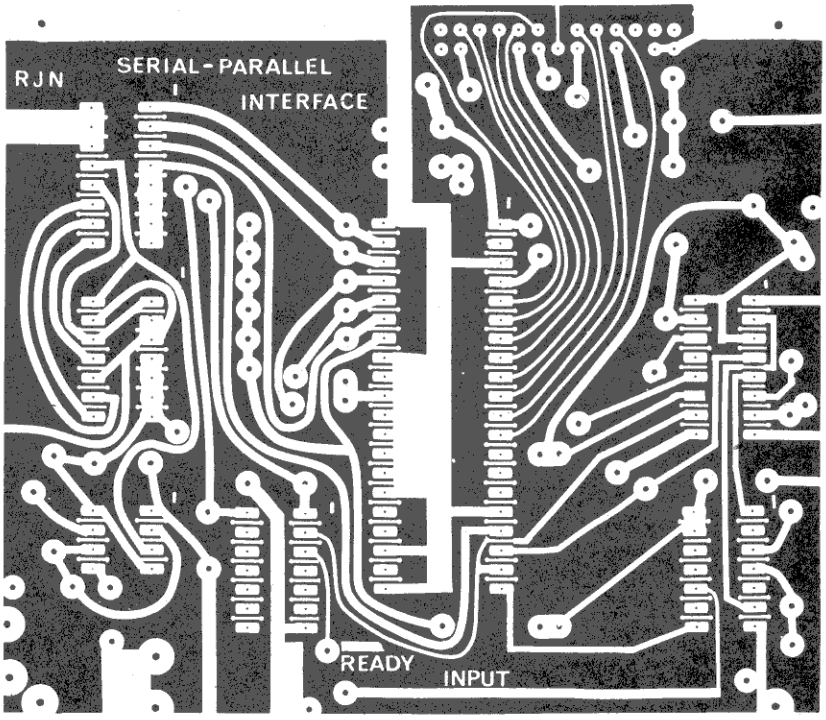

Fig. 3. Circuit-Board Pattern for Type 3 Board

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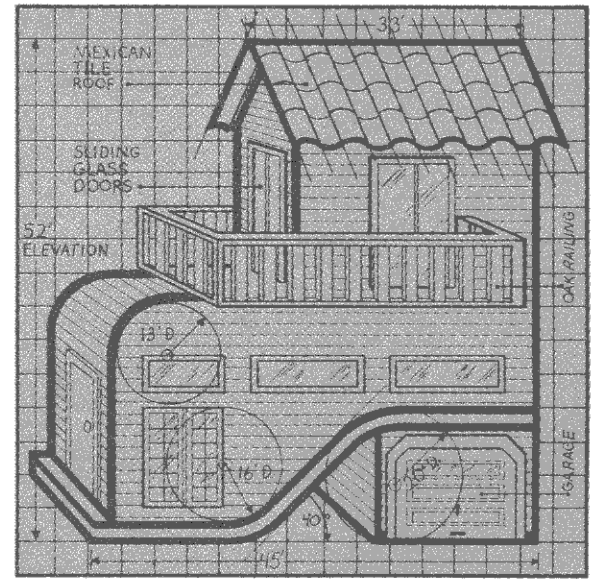

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Internal	External	In/Out	Parallel Mode	Serial Mode
1	32	Out	Error	Error
2	12	Out	Out of paper	Out of paper
3	8	In	Bit 7	Baud rate select
4	11	Out	Busy	Busy
5	7	In	Bit 6	Parity disable
6	10	Out	Acknowledge*	Acknowledge*
7	6	In	Bit 5	Parity disable
8	31	In	Initialize*	Initialize *
9	5	In	Bit 4	Odd/even* parity
10	1	In	Strobe*	Strobe*
11	–	Out	Bit 8	Serial data input
12	–	Out	+12V ac	+12V ac
13	–	Out	Reset*	Reset*
14	–	Out	+12V ac	+12V ac
15	4	In	Bit 3	Baud rate select
16	–	Out	+5V dc	+5V dc
17	3	In	Bit 2	Baud rate select
18	–	Out	+24V dc	+24V dc
19	2	In	Bit 1	8/7* bit select
20	–	Out	+12V dc	+12V dc
21	–	In	Par./Serial* select	Par./Serial select
22	15,18,34	–	No connection	No connection
23	36	In	Printer select	Printer select
24	16,33	–	Signal ground	Signal ground
25	–	In	TRS-80/PET* select	TRS-80/PET* select
26	19 to 30	–	Signal ground	Signal ground
–	14	In	Auto line feed*	Auto line feed*
–	17	–	Chassis ground	Chassis ground
–	35	Out	+5V dc check	+5V dc check
–	13	Out	Select output	Select output

*Asterisk indicates that the signal is active low (at logic 1 when grounded).

Table 2. Connector Pinouts for the MX-80

that the printer deciphers, while board types 3 and 4 feed the printer whole bytes of data in parallel.)

In the printer's internal connector, pin 22 is plugged shut to help align the socket. This means you have to cut that pin on the male connector to make sure it fits correctly when the board is placed in the printer.

The pins on the board's male connector should extend between 5/8 and 3/4 inches below the circuit board. If you use a printed circuit board, don't let any solder bridges form between the pads. You may have to slide down the plastic piece holding the pins in place to allow room for the soldering iron. Solder the connector in place and then slide the plastic piece up again.

If you use a fixed-pattern perfboard, make sure the plastic holding the connector pins in place is flat against the underside of the board to minimize play when putting the board in or taking it out. Use a section of board without any pattern to prevent shorts. If necessary, scrape off the copper pattern in the section of the board where the connector will be.

The pins must extend far enough above the board to allow a wire to be soldered to them on the upper side of the board. Since the pins are only 1/10 inch apart you must also use shrink tubing around the pin/wires—unless you

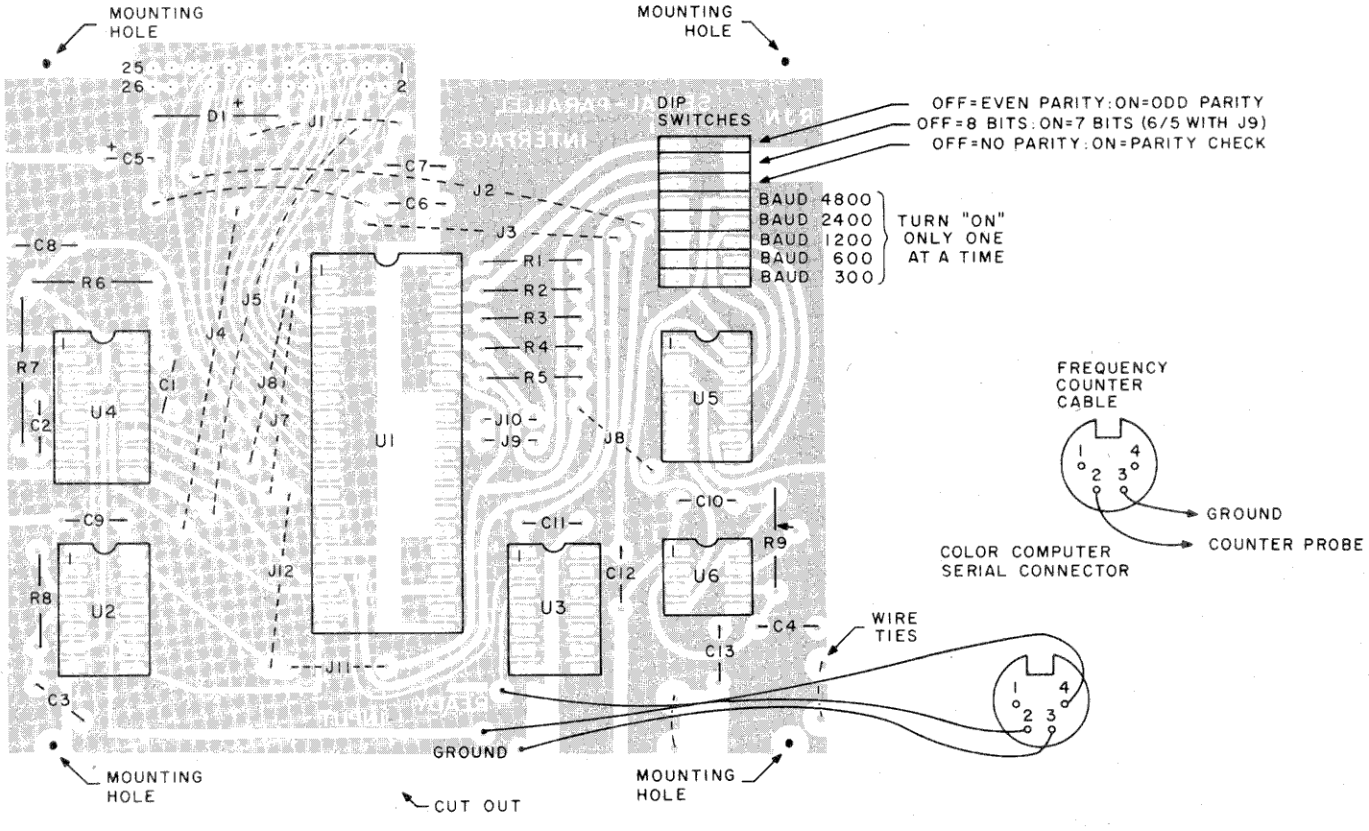
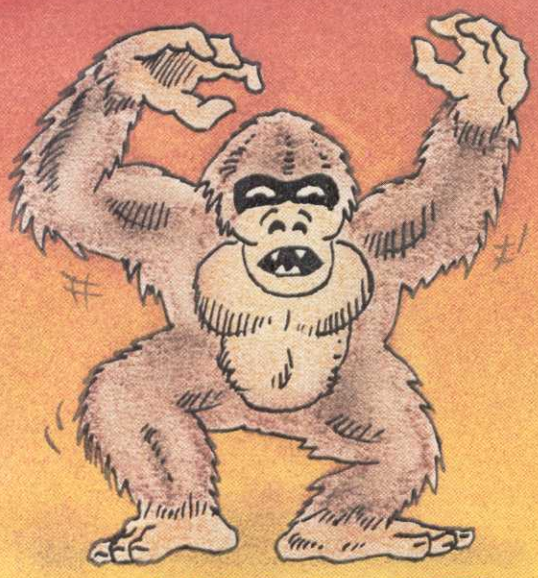
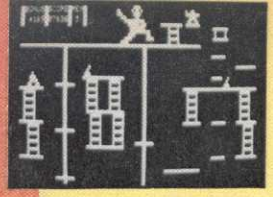


Fig. 4. Type 3 Board Component Placement and Cables





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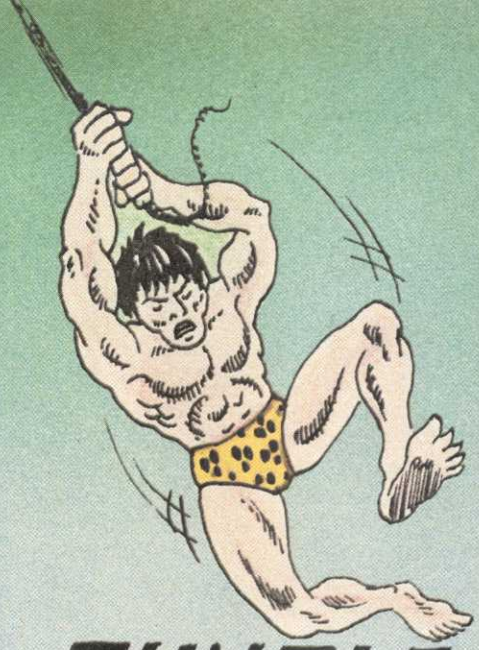

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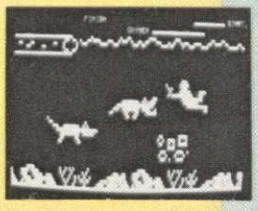

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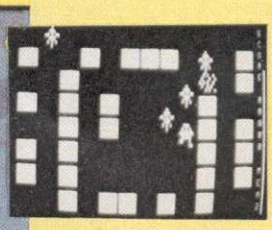

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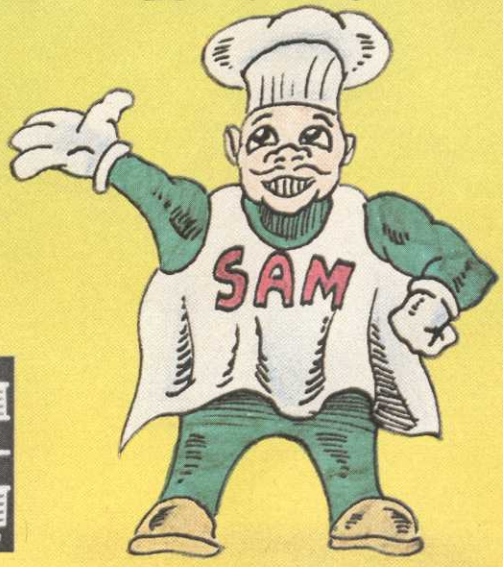

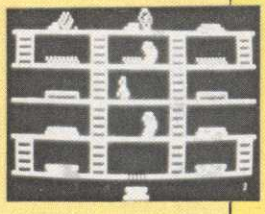

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own stock in Epson, that is. Otherwise, you may have to replace the printer's power supply or other parts in the interface board or printer.

The board must not contact any components inside the printer. Pay particular attention to the tab from the transistor (marked Q1 on the printer's main board) standing next to the large capacitors. If necessary, use a cut-out to give ample clearance around transistor Q1.

You don't need the RS-232 driver chip (type 1488) for most applications, but use it if you think you may want it some day. In my prototype I used the remaining inverter in the RS-232 receiver chip instead of one on a 1488 because the Color Computer HI/LO threshold is at about 2 volts. This means that voltage levels normally given by TTL logic will trigger my computer's serial input. Since the prototype board I wired up was short on space, there was no sense adding the driver chip.

If your computer uses a type 1489 as receiver or some other circuit with a threshold of about 2V, you may be able to use the remaining 1488 inverter as your driver. (If this explanation baffles you, you should definitely use the 1489. Have some knowledgeable friend help you with the whole project.)

To connect your printer to your computer, hard-wire a suitable connector with a cable long enough to suit your needs. See Fig. 3 and Photo 3. The best printer connector and cable is one from Radio Shack (part no. 26-3020). Cut off one of its connectors and you have a ready-made cable and a spare connector.

Once your board is complete, check it out, solder in sockets for all the ICs, solder in the other components, and insert the board in the printer *without* any of the integrated circuits plugged into their sockets. Make sure the connector goes in right.

Set the DIP switches on the board according to your computer's needs (see Fig. 3). Now power it up (without any of the integrated circuits on the board) in the self-test mode to see that the printer is still operating properly.

"The Epson MX-80 overheats if used in direct sunlight. . . "

Check for +5V and −12V values at the various IC power supply pins as indicated in Fig. 2. After that, connect the red lead of your voltmeter to any +5V location and check the black lead for a reading of +5 volts whenever you touch the ground. Check the ground location at all IC sockets for such a reading.

Once you're sure everything looks good, turn off the power, make sure potentiometer R9 is set about halfway, and insert U5 and U6. Power up again and make sure U6 oscillates (pin 3) and that U5 divides the output of U6 by checking U5 pin 14 (it should be the same frequency as U6 pin 3). Then check U5 pins 12 and 1 (½ the base frequency), U5 pin 10 (¼ the base frequency), U5 pin 9 (1/8), and U5 pin 11 (1/16). Adjust R9 so that the final check above is 4,800 Hz. Now connect your frequency counter lead to U1 pin 17.

By individually switching on each of the five DIP switches that set the baud rates, you should be able to read frequencies of 4,800, 9,600, 19,200, 38,400, and 76,800 Hz. If you used a mica capacitor for C4, the frequencies should be rock-steady.

Depending on the load your counter places on the circuit, you may not see an exact doubling of the frequency when going from 2400 baud (38,400 Hz) to 4800 baud (76,800 Hz). If that is the case, don't worry about it—but set R9 by the 2400 baud value of 38,400 Hz. The reason for this is explained below.

When making frequency measurements be sure to use a high-impedance input to the frequency counter. The 50-ohm inputs often used for high-frequency work load down the chips and give erroneous readings. In particular, the output of oscillator U5 changes somewhat (usually less than 1 percent) depending on the output loading. This is why, in general, your final frequency check should be on the lower frequencies after the circuit is complete and U5 divides the frequency down. You may

```
10 CLS
20 PRINT "   FREQUENCY COUNTER PROGRAM":PRINT "      BY RALPH J. NA
VARRETE"
30 PRINT:PRINT"PROGRAM WILL NOT RETURN TO BASIC UNLESS A GROUND CO
NNECTION IS   MADE AND THE SIGNAL TO BE       COUNTED GOES INTO PI
N 2 OF THE  SERIAL CONNECTOR"
40 PRINT:PRINT "COUNTS FOLLOW AND REPEAT WHILE   THERE IS A SIGNAL
 ON THE INPUT"
50 PRINT:PRINT "IF RUNNING, HOLD ANY KEY TO STOP IF STALLED, PRESS
 RESET TO FORCE BACK TO BASIC"
60 INPUT "PRESS ANY KEY TO COUNT";A$
70 DATA CE,0,0,86,C3,B7,1,13,86,C4,B1,1,13,26,F9,B6,FF,22,84,1,26,
F9,33,41,7D,1,13,2C,9,B6,FF,22,84,1,27,F9,20,E9,1F,30,7E,B4,F4
80 FOR I=1536 TO 1578
90 READ A$
100 C$="&H"+A$
110 POKE I,VAL(C$)
120 NEXT I
130 DEF USR0=1536
140 CO=0
150 A=USR0(A)
160 CO=CO+1
170 PRINT "COUNT #"CO"=";A
180 IF INKEY$<>"" THEN END
190 GOTO150
```

Program Listing 1. Low-Frequency Counter for the Color Computer

```
1536 0600 CE0000    LDU  #$0000  0
1539 0603 86C3      LDA  #$C3    195
1541 0605 B70113    STA  $0113   275
1544 0608 86C4      LDA  #$C4    196
1546 060A B10113    CMPA $0113   275
1549 060D 26F9      BNE  $0608   1544
1551 060F B6FF22    LDA  $FF22   65314
1554 0612 8401      ANDA #$01    1
1556 0614 26F9      BNE  $060F   1551
1558 0616 3341      LEAU U+$1    1
1560 0618 7D0113    TST  $0113   275
1563 061B 2C09      BGE  $0626   1574
1565 061D B6FF22    LDA  $FF22   65314
1568 0620 8401      ANDA #$01    1
1570 0622 27F9      BEQ  $061D   1565
1572 0624 20E9      BRA  $060F   1551
1574 0626 1F30      TFR  U,D     0
1576 0628 7EB4F4    JMP  $B4F4   46324
```

Program Listing 2. Disassembly of Machine-Language Portion of Listing 1

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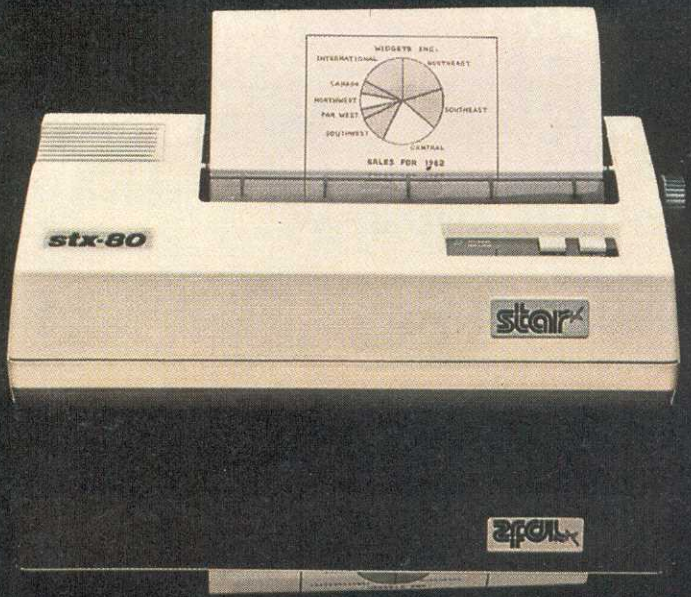

The new STX-80 printer for only $199.*

```
10 'COLOR COMPUTER SCREEN DUMP PROGRAM FOR PMODES3/4 AND MX-80
20 ' BY RALPH J. NAVARRETE
30 ' PROGRAM TAKES SOME 40 MINUTES
40 ' PROGRAM CAN BE SPEEDED UP BY 30% IF SAM CHIP PUT IN ADDRESS D
EPENDANT MODE FOR LINES WHICH DO NOT OUTPUT TO PRINTER
50 PCLEAR 8
60 CLS:PRINT " COLOR COMPUTER HIGH RESOLUTION":PRINT "   BASIC LAN
GUAGE SCREEN DUMP":PRINT "      BY RALPH J. NAVARRETE"
70 PRINT@128,"";:INPUT"WHITE(W) OR BLACK(B) DOTS";C$:IF C$="" ORC$
="B" THEN PRINT@155,"BLACK";:C$="B" ELSE PRINT@155,"WHITE";
80 INPUT "GRAPHICS START AT PAGE #";NN
90 NN=FIX(NN*3 + 0.2)*512
100 TIMER=0
110 PRINT#-2,CHR$(27)"1"      'CARRIAGE RETURN=SPACE OF 7 DOTS
120 M=20
130 FOR I=0TO27
140 PRINT "     ";
150 PRINT#-2,STRING$(20,32);CHR$(27)"K"CHR$(0)CHR$(1);   '256 BYTE
S OF DOTS FOLLOW
160 N=NN
170 P=33
180 Q=128
190 P=P-1
200 IF P=0 THEN PRINT"I="I" TIME="TIME+TIMER/3600:TIMER=0:PRINT#-2
:NEXT I:GOTO340
210 D=0
220 R=0
230 J=64
240 XX=N+I*224+D:R=R+(PEEK(XX) AND Q)*J/Q
250 J=J/2
260 D=D+32:IF D<193 THEN 240
270 PRINT STRING$(6,8)XX;
280 IF C$="W" THEN R=255-R
290 IF I=27 THEN R=INT(R/16)*16
300 PRINT#-2, CHR$(R);
310 Q=Q/2:IF Q>.6 THEN GOTO210
320 N=N+1
330 GOTO180
340 PRINT "TIMER="TIMER,"END"
```

Program Listing 3. Basic Program for Color Computer Screen Dump (PMODEs 3 or 4)

also want to check the frequency at U6 pin 1 (38,400 Hz) after running the printer a while, or if it gets overheated, since capacitors tend to age and slightly change value with time. In my experience, the Epson MX-80 overheats if used in direct sunlight or in room temperatures of over 90° F.

In place of a frequency counter you may use Program Listings 1 and 2 with the test cable (made with the spare connector from the Radio Shack printer cable) shown in Fig. 4. This combination accurately measures frequencies between about 10 Hz and 5,000 Hz through pin 2 of the Color Computer serial port.

Higher and lower frequencies yield erroneous results; very slow frequencies (0–2 Hz) may make the program seem to lock up since it may not be able to return to Basic. For the range indicated, the program is accurate plus or minus 5 Hz. It comfortably measures the relatively square TTL digital signals in this project, but only at the 4,800 Hz source for 300 baud (U5 pin 11). If you get this value, however, all the others will most probably be right also.

If the relative error of 5 Hz bothers you, note that it is only an error of 1/10 of 1 percent of the 4,800 Hz. The exact

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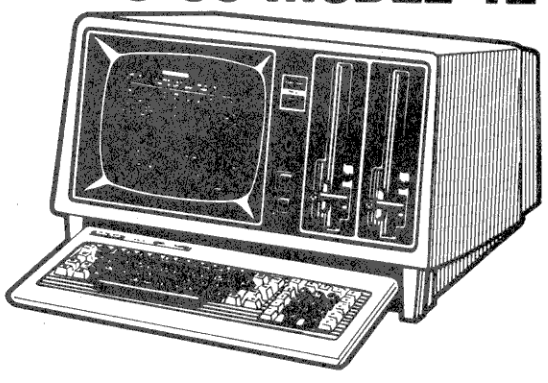

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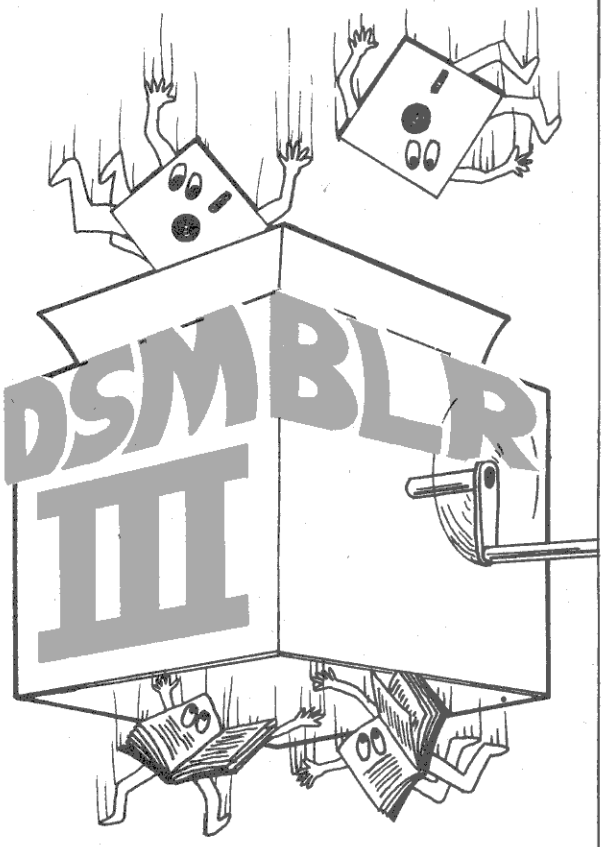

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values I obtained with my computer are in Table 3.

If you use the cable and program for other projects, note that the combination is unsuitable for low-amplitude signals, for circuits requiring very high impedance inputs, or for square waves having narrow high or low portions.

Next, insert all the remaining ICs (watch for the correct orientation) and apply power again in the self-test mode. If it works, you're ready to print.

Assuming you previously set both the board and your computer to identical baud rates, parity, and word length, send a stream of line feeds to your printer and watch the paper fly. Try whichever of the following programs fits your machine:

```
10 PRINT #-2, CHR$(10);
20 GOTO 10
```

Or, for the Models I and III:

```
10 LPRINT CHR$(10);
20 GOTO 10
```

Once you pass this test you can print anything you like. You'll have to fiddle with the bountiful supply of Epson DIP switches to try other modes.

Model I and III owners shouldn't have trouble dumping their block graphics screens to the original MX-80 or with Graftrax-80. Only remember, in certain modes you must add a constant offset to the value in memory, since the number for each block type is not always the same for the printer and the Model I/III. Graftrax-Plus does not support block graphics.

True value	Readings
10 Hz	11-12
100 Hz	101-102
1,000 Hz	997-1005
4,800 Hz	4800-4804

Table 3

Dot-Addressable Graphics

In theory, Model I/III owners can compose dot graphics by setting aside memory space, composing the graph (without seeing it) and then dumping it to the printer. Color Computer owners have it much simpler since what we see is what we get.

Program Listings 3 and 4 present two equivalent programs for dumping PMODE 3 and 4 screen graphics from the Color Computer to the MX-80. The first program is in Basic and the second is a combination of Basic and machine language.

The main difference is that the Basic program takes about 40 minutes to run, during which the printer sits still most of the time. The second program, however, takes only about 1.8 minutes to

```
10 'COLOR COMPUTER SCREEN DUMP PROGRAM FOR PMODES 3/4 AND MX-80
20 'BY RALPH J. NAVARRETE
30 'CHANGE ALL 32XXX VALUES IN LISTING BELOW TO 16XXX FOR 16K MACH
INES
40 'PROGRAM TAKES SOME 100 SECONDS
50 PCLEAR 8
60 CLEAR 500,32000
70 DATA 31,&H50,195,  0, 15, 31,  2, 32, 21
80 DATA 134,254,183,0,111,166,60,167,32,236,56,237,62,134,128,167,
33,111,34,,111,35,111,36,&H86,064,&HA7,37,&HA6,38,198,224,61,227,3
4,227,62,31,1,166,132,164,33,230,33
90 DATA &HC1,1,&H27,4,&H44,&H54,32,&HF8,&HE6,&H25,&HC1,1,&H27,4,&H
48,&H54,32,&HF8,171,36,167,36,100,37,204,0,32,227,34
100 DATA 237, 34,16,131,  0,224,38,&HCA,166,36,230,&H3A,39,01,&H43
,&HE6,38,&HC1,27,38,8,68,68,68,68,72,72,72,72,&HAD,&H9F,&HA0,&H02,
&H64,&H21,&H26,&HA3,&HEC,&H3E,&HC3,0,1,&HED,&H3E,&H6A,&H20,&H26,&H
94,&H39,0,0,0,0,0,0
110 CLS:PRINT " COLOR COMPUTER HIGH RESOLUTION":PRINT "   BASIC/AS
SEMBLY SCREEN DUMP":PRINT"      BY RALPH J. NAVARRETE"
120 PRINT @ 128,"    POKING MACHINE LANGUAGE"
130 FOR I=32001 TO 32009
140 READ X : POKE I,X : NEXT I
150 FOR I=32031 TO 32155
160 READ X : POKE I,X : NEXT I
170 DEF USR0=32001
180 PRINT@ 128,"";:INPUT"WHITE(W) OR BLACK(B) DOTS";C$:IF C$="" OR
 C$="B" THEN PRINT@ 155,"BLACK";:POKE 32012,0 ELSE PRINT@ 155,"WHI
TE";:POKE 32012,1
190 INPUT"GRAPHICS START AT PAGE #";PAGE
200 PAGE=FIX(PAGE*3 +.02)/3
210 TIMER=0
220 PRINT#-2,CHR$(27)"1"
230 POKE 32014,32  'PP
240 POKE 32010,PAGE*6:POKE 32011,0  'NN
250 POKE 32020,0   'D
260 FOR I=0 TO 27
270 POKE 32024,I
280 PRINT#-2,STRING$(18,32);CHR$(27)"K"CHR$(0)CHR$(1);
290 X=USR0(X)
300 PRINT#-2
310 PRINT" ROW=";:PRINT USING "###";I;
320 NEXT I
330 PRINT"DOTDUMP COMPLETED IN";:PRINT USING "####.#";TIMER/60;:PR
INT " SECS"
340 END
```

Program Listing 4. Basic/Machine-Language for Color Computer Screen Dump (PMODEs 3 or 4)

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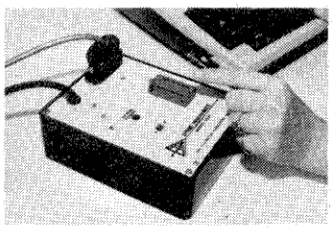

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run (using 4800 baud for the printer) during which the printhead never stops moving. With Graftrax-Plus, it's even faster.

I don't claim that the Basic program is a model of efficiency. I just wrote it to test the algorithm used in the machine-language program.

A disassembly of the position-independent machine-language code is found in Program Listing 5. Note that the locations between 32010 and 32030 are reserved as storage for variables.

The code, as mentioned previously, is position-independent. It runs correctly in any area of memory, as long as you clear that area to keep the Basic interpreter from using it as a scratch pad. The programs also run whether your computer outputs 7 or 8 bits ASCII code since only seven vertical dots are printed on each pass of the printhead. The programs automatically set the printer to a carriage-return depth of 7/72 inches, or the height of seven dots.

In the Color Computer, each of the 192 horizontal rows is composed of 32 bytes of data from left to right. The programs print 28 rows, each of which is composed of 256 vertical columns seven dots high. The programs read 7 bytes of data, representing the first byte of the top seven rows of the screen. Then the leftmost bits of each byte are rearranged into a single byte and sent to the printer.

This process repeats for all 8 bits in those bytes, and the whole process repeats 32 times per row for all 28 rows. Since 28 rows of data add up to 196 dots, when printing the last row (number 27, since the count starts at zero), the bottom four dots are blanked out to keep from printing garbage.

Cassette-system programs require only two pieces of information: whether the picture should be composed of black dots on a white background or vice versa; and the page number where the Extended Basic graphics screen in PMODE 3 or 4 starts.

The answer to the second question can be an integer or thirds of an integer, since a graphics page is 1.5K long. A display can start at any 0.5K boundary if you choose to do your own POKEing instead of using the Extended Basic commands. For example, if the graphics in a machine-language game start at location 8192 (8K), the page entry is 8192/1536, or 5.33.

Since graphics page 1 starts anywhere, depending on how many disk files you have open, disk owners may want to change line 90 in Listing 3 or line 200 in Listing 4 by adding an offset

```
10  32001 7D01 1F50      TFR  PC,D      0
20  32003 7D03 C3000F    ADDD #$000F    15
30  32006 7D06 1F02      TFR  D,Y       0
40  32008 7D08 2015      BRA  $7D1F     32031
50  32031 7D1F 86FE      LDA  #$FE      254
60  32033 7D21 B7006F    STA  $006F     111
70  32036 7D24 A63C      LDA  Y-$4      4
80  32038 7D26 A720      STA  Y+$0      0
90  32040 7D28 EC38      LDD  Y-$8      8
100 32042 7D2A ED3E      STD  Y-$2      2
110 32044 7D2C 8680      LDA  #$80      128
120 32046 7D2E A721      STA  Y+$1      1
130 32048 7D30 6F22      CLR  Y+$2      2
140 32050 7D32 6F23      CLR  Y+$3      3
150 32052 7D34 6F24      CLR  Y+$4      4
160 32054 7D36 8640      LDA  #$40      64
170 32056 7D38 A725      STA  Y+$5      5
180 32058 7D3A A626      LDA  Y+$6      6
190 32060 7D3C C6E0      LDB  #$E0      224
200 32062 7D3E 3D        MUL             0
210 32063 7D3F E322      ADDD Y+$2      2
220 32065 7D41 E33E      ADDD Y-$2      2
230 32067 7D43 1F01      TFR  D,X       0
240 32069 7D45 A684      LDA  X+0       0
250 32071 7D47 A421      ANDA Y+$1      1
260 32073 7D49 E621      LDB  Y+$1      1
270 32075 7D4B C101      CMPB #$01      1
280 32077 7D4D 2704      BEQ  $7D53     32083
290 32079 7D4F 44        LSRA            0
300 32080 7D50 54        LSRB            0
310 32081 7D51 20F8      BRA  $7D4B     32075
320 32083 7D53 E625      LDB  Y+$5      5
330 32085 7D55 C101      CMPB #$01      1
340 32087 7D57 2704      BEQ  $7D5D     32093
350 32089 7D59 48        ASLA            0
360 32090 7D5A 54        LSRB            0
370 32091 7D5B 20F8      BRA  $7D55     32085
380 32093 7D5D AB24      ADDA Y+$4      4
390 32095 7D5F A724      STA  Y+$4      4
400 32097 7D61 6425      LSR  Y+$5      5
410 32099 7D63 CC0020    LDD  #$0020    32
420 32102 7D66 E322      ADDD Y+$2      2
430 32104 7D68 ED22      STD  Y+$2      2
440 32106 7D6A 108300E0  CMPD #$00E0    224
450 32110 7D6E 26CA      BNE  $7D3A     32058
460 32112 7D70 A624      LDA  Y+$4      4
470 32114 7D72 E63A      LDB  Y-$6      6
480 32116 7D74 2701      BEQ  $7D77     32119
490 32118 7D76 43        COMA            0
500 32119 7D77 E626      LDB  Y+$6      6
510 32121 7D79 C11B      CMPB #$1B      27
520 32123 7D7B 2608      BNE  $7D85     32133
530 32125 7D7D 44        LSRA            0
540 32126 7D7E 44        LSRA            0
550 32127 7D7F 44        LSRA            0
560 32128 7D80 44        LSRA            0
570 32129 7D81 48        ASLA            0
580 32130 7D82 48        ASLA            0
590 32131 7D83 48        ASLA            0
600 32132 7D84 48        ASLA            0
610 32133 7D85 AD9FA002  JSR  ($A002)   40962
620 32137 7D89 6421      LSR  Y+$1      1
630 32139 7D8B 26A3      BNE  $7D30     32048
640 32141 7D8D EC3E      LDD  Y-$2      2
650 32143 7D8F C30001    ADDD #$0001    1
660 32146 7D92 ED3E      STD  Y-$2      2
670 32148 7D94 6A20      DEC  Y+$0      0
680 32150 7D96 2694      BNE  $7D2C     32044
690 32152 7D98 39        RTS             0
```

Program Listing 5. Disassembly of Machine-Language Portion of Listing 4

```
10 '2 COLOR DUMP
20 PMODE 4,1:PCLS:SCREEN 1,1
30 LINE (4,3)-(251,188),PSET,B
40 LINE (8,6)-(247,185),PSET,B
50 LINE (0,191)-(255,0),PSET
60 CIRCLE (192,144),30
70 CIRCLE (64,48),30
80 PAINT (192,144)
90 PAINT (64,48)
100 GOTO100
```

Program Listing 6. Produces Graphics in Fig. 5

for the space used by the disk drive. This is usually 2048 for Listing 3 and 4 for Listing 4.

Always make sure you don't position the program where it writes over the graphics. For graphics starting on page 1, load and run the program with PCLEAR 4 or 8. If the graphics are very high in memory, however, load and run the program in a very low area, like PCLEAR 1 followed by a suitable Clear statement such as CLEAR 500,7679.

For an example of a two-color graphics screen dump using these programs, see Fig. 5. This screen is made by the program in Listing 6 and is printed both with white and black dots so you can see how the negative image looks.

Even more interesting is the screen dump of a four-color high-resolution screen (Fig. 6) generated by the program in Listing 7. In PMODE 3, a pair of bits represents a double-width pixel on the television screen. Each set of 2 bits can be set to 00, 01, 10, or 11, with each of those binary numbers representing one of four colors. Because the screen dump program prints memory contents bit by bit, colors represented by 01 and 10 result in vertical stripes with adjacent areas filled with those two different striped patterns appearing in alternate columns. ■

Ralph Navarrete can be reached at P.O. Box 492, Piscataway, NJ 08854.

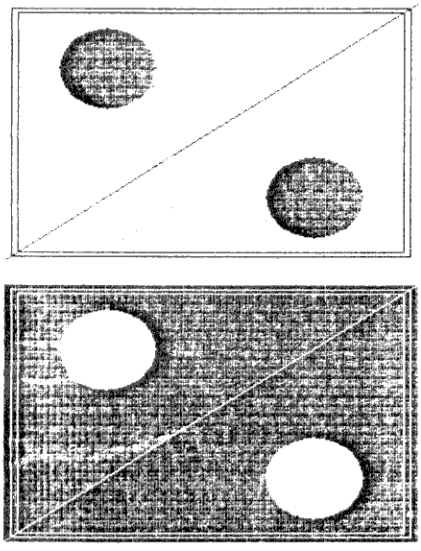

Fig. 5. PMODE 4 (Two-color) Screen Dump

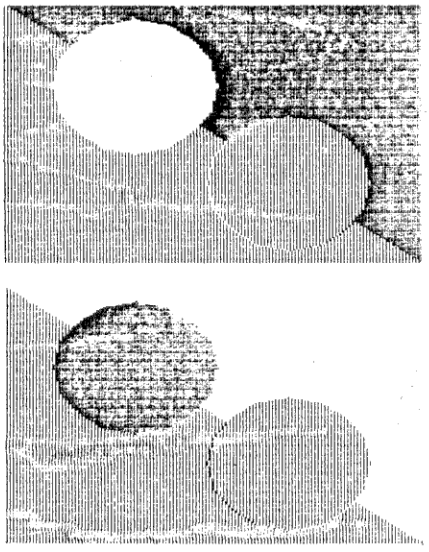

Fig. 6. PMODE 3 (Four-color) Screen Dump

```
10 '4 COLOR DUMP
20 PMODE3,1
30 A=5:B=6:C=7:D=8
40 COLOR C,D
50 PCLS
60 SCREEN1,0
70 LINE (0,0)-(255,191),PSET
80 PAINT (10,30)
90 CIRCLE (80,60),50,A
100 PAINT (80,60),A
110 CIRCLE (175,132),50,B
120 PAINT (175,132),B
130 END
```

Program Listing 7. Produces Graphics in Fig. 6

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Edit without Retyping with insert & delete	YES	YES	NO	NO
Restrict field Length automatically	YES	YES	YES	NO
Unlimited Restriction choice for each field	YES	YES	NO	NO
User defined Custom Prompts for each Field	YES	YES	NO	NO
Full Speed Typing in ALL Fields	YES	YES	NO	YES
Immediate Exit from Any Field to Menu	YES	YES	NO	YES
Enter Fields from last Record automatically	YES	YES	NO	NO
Fast BTREE File Structure (No Sort Needed)	YES	YES	NO	NO
Find Record with Part of a Key	YES	YES	NO	NO
Hi-Speed Global Search for ANY Field in a Record	YES	YES	NO	NO
Duplicate Keys and Multiple Keys Supported	YES	YES	limited	NO
Global Field Replacement Function	YES	YES	NO	NO
Run Predefined Reports from Finished Program	YES	YES	NO	NO
Select Reports from Menu in Finished Program	YES	NO	NO	NO
Sort (machine language) ANY Field-Free	YES	NO	NO	NO
Custom Mailing Labels Option (any Size)	YES	NO	NO	NO
Do Calculations on fields in Program	YES	YES	YES	NO
Sell Finished Program with No Royalty	YES	YES	NO	NO
PRODUCER CAPABILITIES & FEATURES				
Toll Free Question Line	YES	YES	NO	NO
Create PROFESSIONAL Finished Program	YES	YES	NO	NO
Modify Program without Starting Over	YES	YES	NO	NO
Ease of Use, including Complete TUTORIAL	YES	NO	NO	NO
Number of Calculations allowed per field	8	8	1	0
Use Field Names for Calculations	YES	NO	NO	NO
Use ALL Math Functions in Calculations	YES	NO	NO	NO
Generates a BASIC Program	YES	YES	YES	YES
Custom Design exact Screen YOU desire	YES	YES	NO	NO
Full Feature Screen Generator (graphics)	YES	NO	NO	NO
Easy Report Generation with Any Restrictions	YES	NO	NO	NO
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Free Menu Driven DOS Utility Package	YES	YES	NO	NO
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For an independent product review of the PRODUCER see page 62 of March issue of 80 Micro.

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C·Notes

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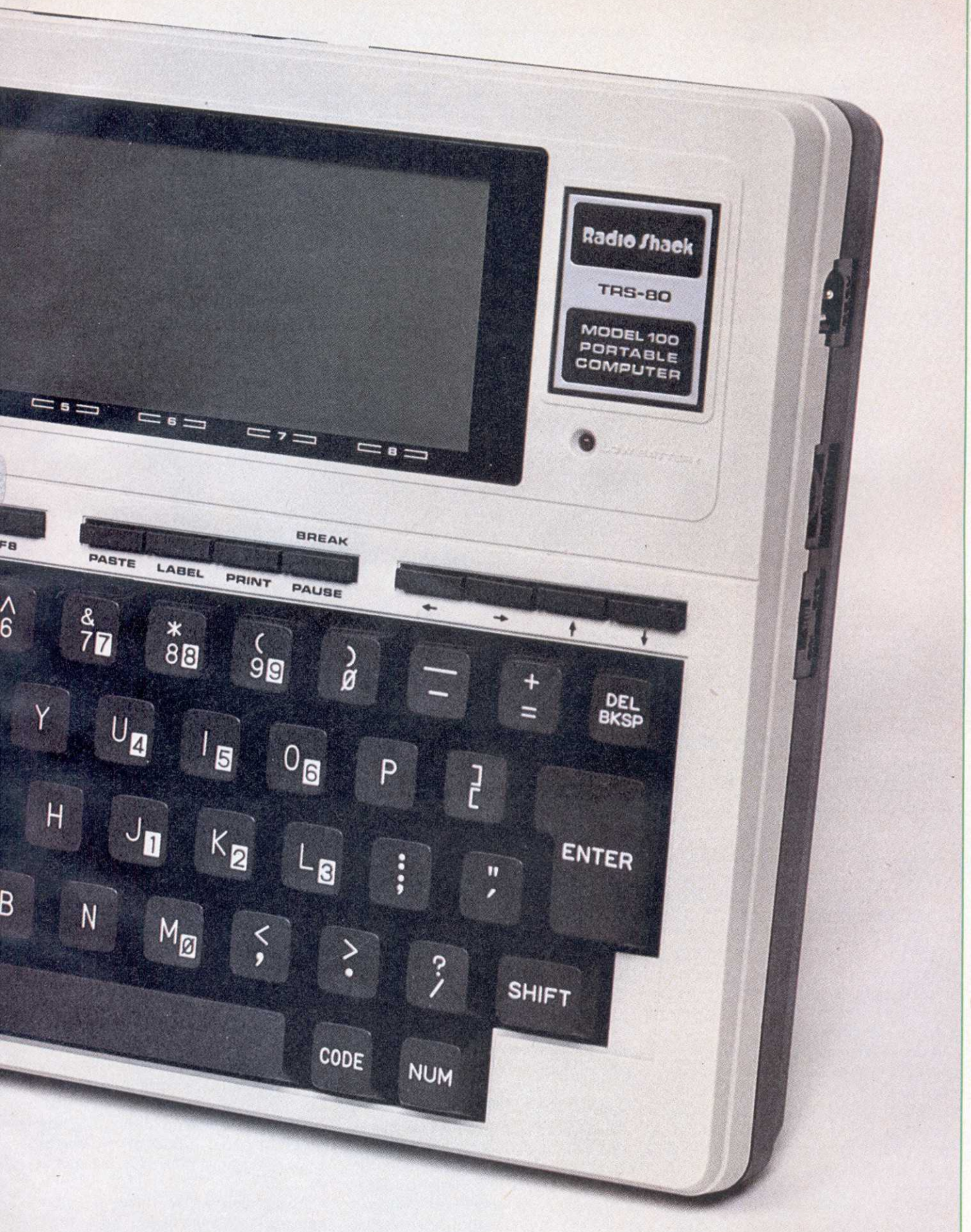
All photographs in this section by Frank Cordelle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Tandy's Towering Totable

by John Berman

The Model 100 is all you could want in a portable—powerful, versatile, and lightweight.

Radio Shack's Model 100 marks the beginning of a new era in microcomputers. Just as the Model I revolutionized the microcomputer industry in 1977, the Model 100, a powerful, inexpensive, completely equipped (except for disk drives and printer), battery-powered portable with built-in software, will have a similar effect on the microcomputer market of today.

After looking at the machine and its market, I believe Tandy is going to sell more of these portables than the number of Models I and III combined, something on the order of one million units. And I think they'll sell half of them the first year the computer is available.

To back up this rather outlandish claim, let me tell you about the computer. When I'm done, I'm sure you'll agree that it's the most significant advance in computers this year.

Physical Specifications

The Model 100 measures 11¾ inches wide by 8½ inches high by 1 7/8 inches deep. It weighs four pounds, about the size and weight of the Model III TRS-DOS manual. To quote Radio Shack's publicity announcement, "any smaller and the standard-sized keyboard wouldn't fit, any lighter and the unit would slide across your worktable."

In fact, the unit's dimensions were dictated almost entirely by human-use (ergonomic) considerations. It features a full-sized typewriter-style keyboard with normal keys (not chicklet keys like the Color Computer, nor membrane keys like the Atari 400).

The keys have a solid feel, and give an easily audible "click" as they hit the bottom-stop when pressed. All keys have automatic key repeat if held down for more than a second.

The entire keyboard/display is gently sloped at about a one- or two-degree angle for easy viewing when the unit is on a table.

In addition to the standard alphanumeric and punctuation keys, there are special keys for computer functions.

These special keys are escape, delete, backspace, tab, caps lock, code, graph, number, and control keys.

The code key generates foreign-language letters with appropriate accent marks for French, Spanish, German, and other languages. The graph key puts graphics blocks, lines, and symbols on the display. The control key generates computer control codes 1–26.

The numeric key converts the U,I,O, J,K,L, and M keys into a numeric keypad, indicated by small number blocks in the lower right corner of each key. While the keys aren't aligned like a standard keypad, and there isn't a telltale bump on the I (5) key, it's better than no keypad at all.

The graph and code keys are also used with the shift key to give you an alternate set of graphics and letters. This means that all 255 displayable characters can be generated from the keyboard by one or another combination of keys. Unfortunately, using the control, code, and graph keys requires both hands. This is a problem for the handicapped since the keyboard is too wide to be spanned with one hand.

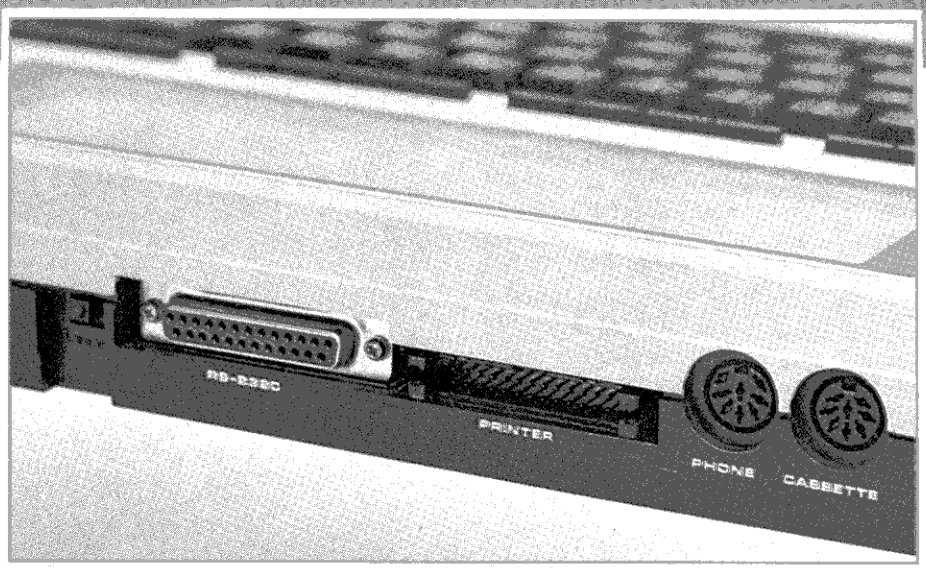


Photo 1. The back side of the Model 100. From left, the components are the reset button, RS-232 port, parallel printer port, phone jack, and cassette jack.

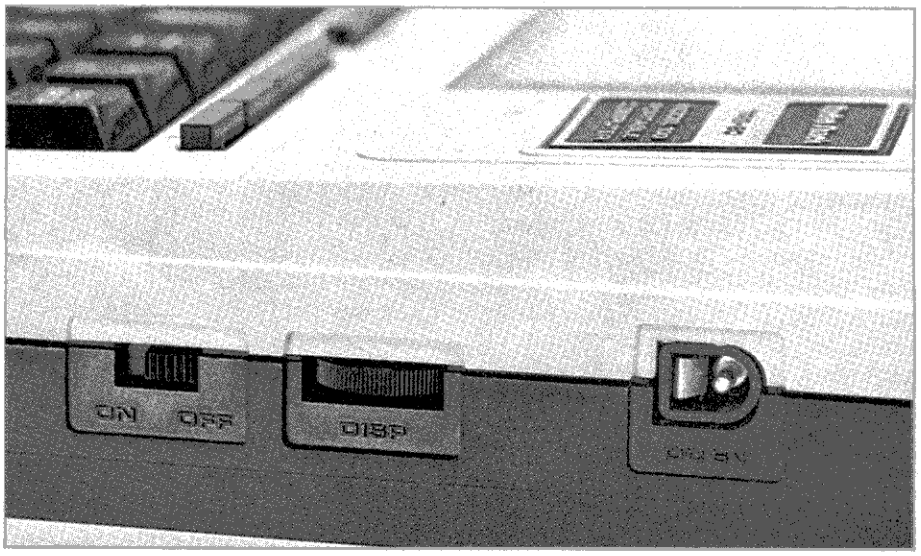


Photo 2. Right side of the Model 100 showing (from left to right) the on/off switch, display adjustment, and 6V dc power jack.

The Display

The display is an eight-line by 40-character liquid crystal display (LCD), four times the size of the Epson HX-20 display. It's large enough to prevent most complaints about LCD displays being too small for serious work, but small enough to maintain the unit's portability.

The LCD features dot-addressable graphics of 64 rows by 240 columns that can be mixed with text for games, charts, and graphs.

The display also includes a dial to adjust the viewing angle of the LCD, so you can put the computer at almost any angle and position the display for maximum visibility. Because the LCD display uses reflected light to illuminate the display, it puts to rest one of the major complaints about video terminals: radiation-induced eye fatigue. (Radio Shack experimented with an LCD display of two 40-character banks, for a total display size of 80 columns by eight lines, but in user field tests discovered that it was a cumbersome system that most people didn't like.)

One disadvantage to the LCD display is its lack of speed. The response time is quite slow and has a marked effect on the speed of program execution. I wrote a simple For. . . Next loop that counted to 800, and had the program display both starting and ending times.

It took approximately one second for the loop to execute. Adding a "PRINT@0,I" in the loop slowed execution time down to 14 seconds. Changing the PRINT@ to simply PRINTI, forcing the entire display to scroll one line for each number, slowed the display down so much that it took 33 seconds just to count to 100! A definite handicap since the CPU operates at 2.4 MHz.

Between the keyboard and the display is a line of 16 small buttons in four groups of four. The two sets on the left are special-function buttons, labeled F1–F8. Depending on which software program you're using, their definitions change, although in Basic you can redefine them to whatever you want (there are space limitations to those definitions, of course).

The third group of buttons is labeled Paste, Label, Print, and Break/Pause. The Paste button is used in conjunction with the text editor; more on that later.

The Label button pertains to the function buttons labeled F1–F8, and uses the bottom line of the LCD display to show the definitions currently assigned to those buttons. A series of white boxes are evenly spaced across the bottom line of the display. The boxes are numbered 1–8 to correspond to the function buttons. The internal design constraints of the keyboard and LCD display circuitry prevented placement of the eight special-function buttons directly below the LCD.

The Print button sends either the dis-

play contents or the entire file being edited to the printer port.

The Break/Pause button either pauses program or listing execution (like shift @ on the Model I/III and Color Computers) or, when shifted, breaks program execution (it prints Control-C on the display when you do that).

The rightmost set of four buttons moves the cursor left, right, up, and down. It would have been more convenient if the buttons were arranged in a diamond pattern, but the size of the LCD circuit board precluded that set-up.

On the left side of the computer are two switches to control the modem and a bar-code reader. On the right side of the computer is the on/off switch, the display-angle adjustment, and the external power supply (6V dc) connector. At the back side of the computer are the rest of the peripheral connectors: cassette port, modem jack, Centronics parallel printer port, and a DB25 RS-232 connector.

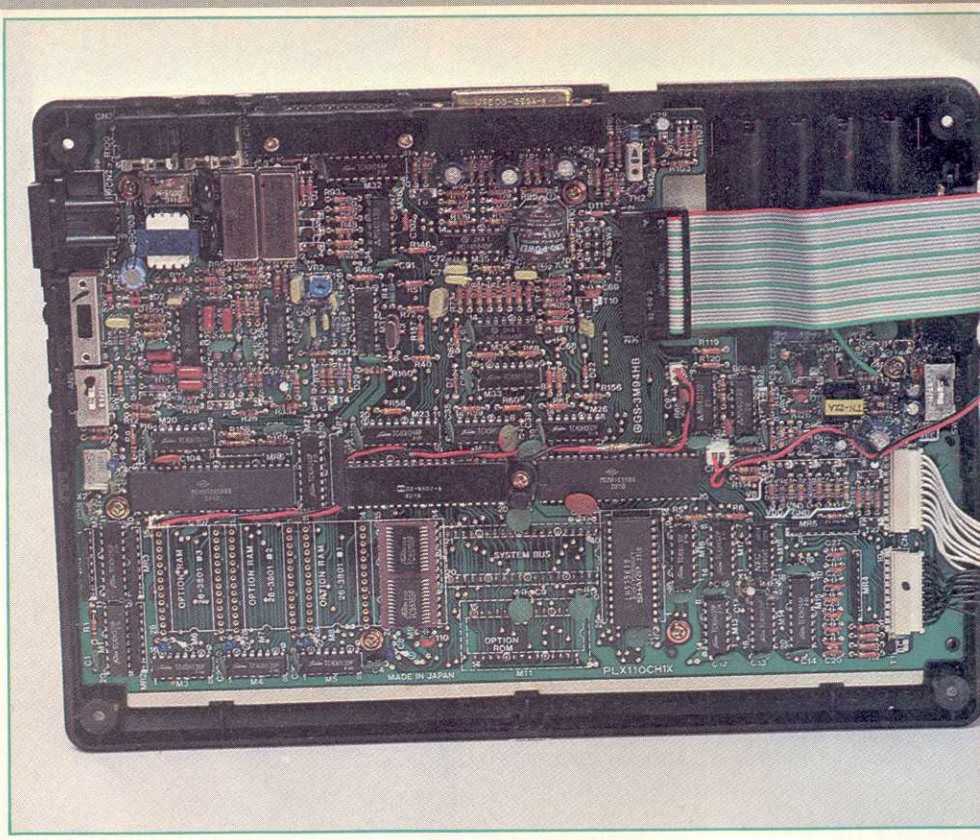


Photo 3. The inside of the Model 100. The main circuit board is on the

Hardware

The computer includes most of the hardware features desired by computer users, including a built-in, direct-connect, auto-dial modem (originate and answer, with an optional cable to attach a modular phone line), a cassette port that uses the standard Radio Shack cassette cable and tape recorders, a 26-pin Centronics-compatible parallel port connector, and an RS-232 port. The computer also has a jack for an acoustic 300-baud modem for non-modular phones.

One feature adds considerably to the computer's reliability. Not only is it powered by batteries (four AA cells), but an internal Ni-Cad battery powers RAM when you turn off the computer.

The Ni-Cad batteries maintain your memory after the other batteries go dead for up to 30 days with an 8K computer, eight days with a 32K computer. And the optional ac power supply recharges the batteries while you're using the computer, extending their lives indefinitely.

The AA batteries are used primarily to power the LCD, peripheral ports, and CPU. Using standard batteries you have about 20 hours of computing time before you'll have to replace them. When you have less than about 20 minutes of life left in the batteries, a low-power LED comes on. I ran mine for almost 40 minutes before my batteries finally gave out.

To see what would happen, I tried to CSAVE a program with weak batteries. About halfway through, the computer shut itself down and turned off the remote control on the tape recorder. Replacing the dead batteries with fresh ones restored the display, which still indicated CSAVE, but nothing was happening. I had to use the Break button to regain control of the unit.

CLOADing the file failed, since the power went off in the middle of a line of data, but the intact program remained in my computer's memory.

If you were to use AA Ni-Cad batteries, you'd probably get much more than 20 hours of useful life, and you could recharge them as many times as you wanted (well, almost, since even Ni-Cads get too tired to use after a year or so).

To help the batteries last longer, the computer automatically turns itself off if you don't use the keyboard for a specified time. You can set this time limit to anywhere from 60 seconds to 25 min-

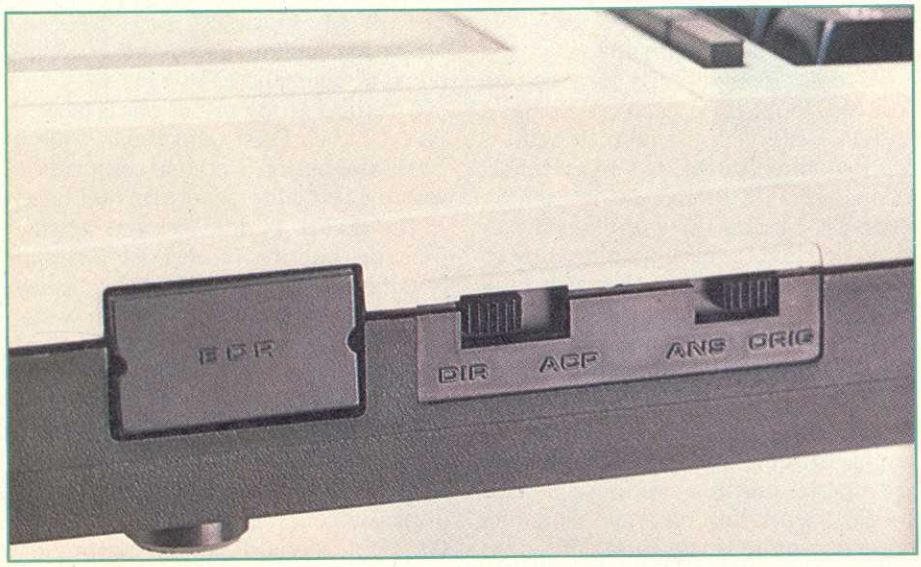
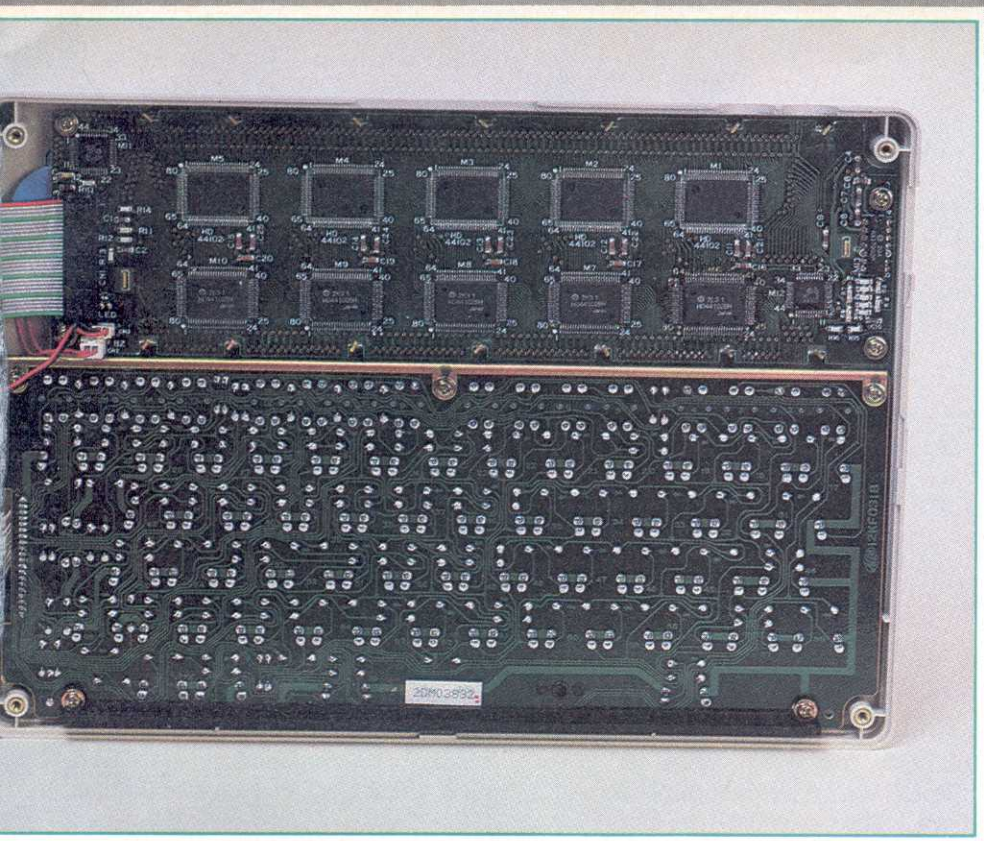


Photo 4. Left side of the Model 100 with (from left to right) the bar code reader port, a direct-connect/acoustic modem switch, and the answer/originate mode switch.



left, the LCD readout (top) and keyboard circuitry are on the right.

utes. The power-off feature is disabled when you're in the term mode of Telcom.

For those interested in expanding the computer's capabilities, there's an expansion port socket under a small door on the bottom of the computer. The same compartment holds an expansion ROM socket to insert software cartridges.

The built-in modems are definitely a good deal, and allow the utmost in flexibility. The Centronics port is a must on almost all computers today, and the RS-232 port is an extension of the modem equipment.

You have complete control over the RS-232. Baud rates of 75, 110, 300, 600, 1200, 2400, 4800, 9600, and 19,200 are acceptable, with 6-, 7-, or 8-bit word lengths; Odd, Even, or no parity is supported as is XON/XOFF status control.

The baud rate is selected by specifying a number from 1–9, or using an M to select the 300-baud modem instead of the RS-232 port. All this is done with software; there aren't any hardware switches to play with.

Examining the inside of the computer is an experience in advanced technology. All the chips are CMOS design (complementary metal-oxide semiconductors), with extremely low power drain. The ROM is a special 32K package of eight smaller flat-pack CMOS ROM chips.

The RAM chips, in the lower left corner of the unit, comprise four CMOS flat-pack chips per 8K bank of RAM. Two chips are on top and two are on the bottom of each special RAM pack carrier chip.

The direct-connect modem hardware is in the upper left corner of the unit, and the expansion port and expansion ROM socket are in the bottom center of the case.

It's almost incredible that they managed to pack so much capability in little hardware.

Firmware

The firmware (software stored in ROM) is as impressive as the rest of the machine. In fact, the firmware is what makes the Model 100 such an exceptional computer. It's one of the first computers to supply all the software required by most first-time computer users as an integral part of the computer. The Model 100 gives you a Basic that's more powerful than any I've ever seen, far better than the Basic on Radio Shack's other computers.

The simple word processor takes only a few minutes to learn, but is powerful enough to satisfy most writers' requirements.

A telecommunications program is provided that goes far beyond the packages sold by Radio Shack for their other computers. And there's an address-file program that can be used with the Telcom program to dial phone numbers for you, both on rotary-dial systems and on push-button phones (this feature works only with the direct-connect phone cable attached).

Finally, there's a schedule program to store important dates and engagements.

The operating system for this machine is easy to use. When you turn on the computer you're presented with a menu display of what's in RAM, along with the month, date, year, day, time, and currently available RAM space.

There's room for 24 file names in the menu, five of which are occupied by

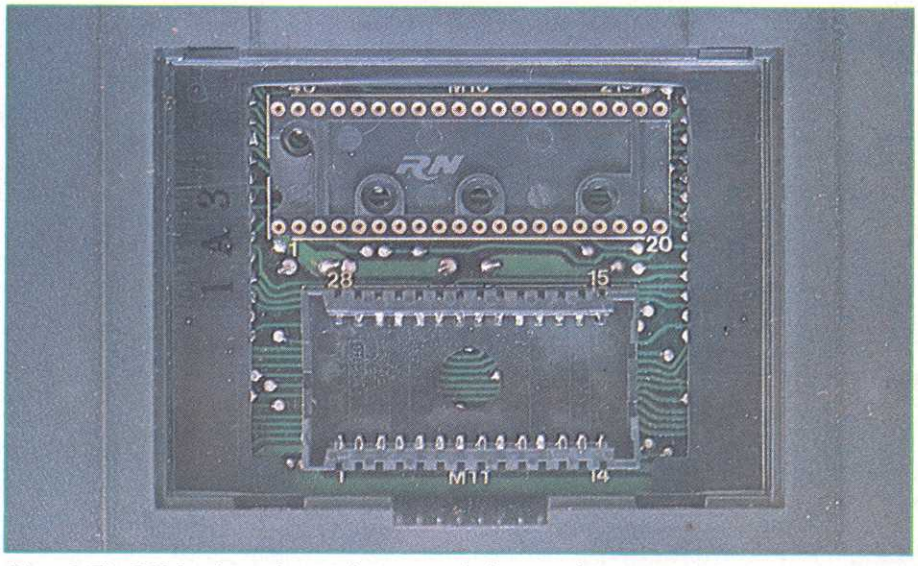


Photo 5. The ROM socket and expansion port on the bottom of the Model 100. (Note: The cover has been removed.)

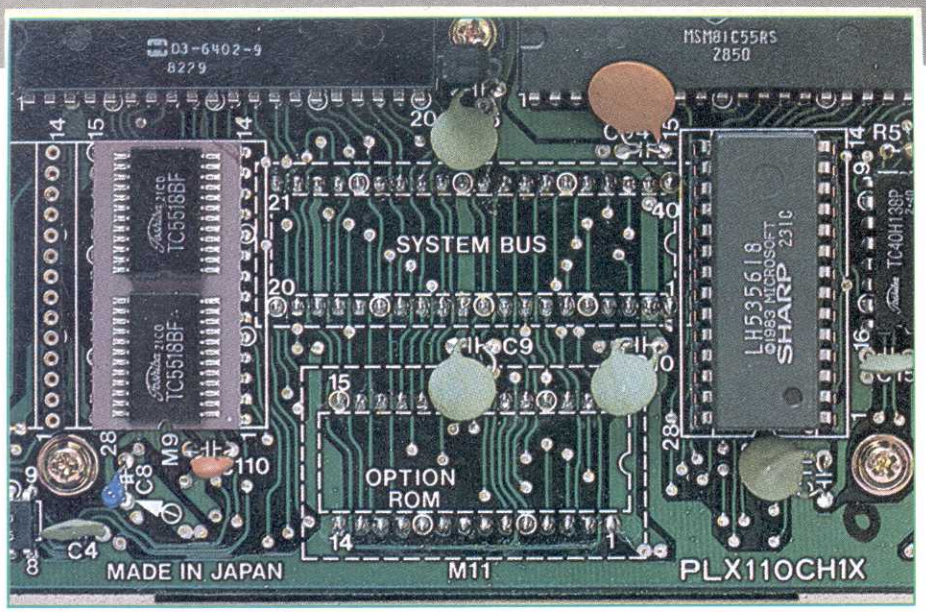


Photo 6. An internal view of the expansion port and ROM socket (see Photo 5).

Basic, Text, Telcom, Address, and Schedule. That's right, RAM is partitioned into RAM files. You can have up to 19 files in RAM, if you have enough room for them all. (An 8K computer has only 5,460 free bytes; the rest is used for display memory, function-key assignments, port addresses, and other things needed by the operating system.)

To select a program or text file, position the cursor over the file name and press enter. If it's a Basic program, Basic is enabled, your program is loaded, and it automatically begins execution. Text files are automatically loaded into the word processor, with the cursor at the beginning of the file. Machine-language files begin executing immediately.

Placing the cursor over Basic or Text loads them without a resident file, although Text does prompt you for a new file name. That way a text file is automatically saved when you return to the menu or turn off the computer.

Basic programs are left in Basic until you either provide a name to save them in RAM, or type New and wipe them out. Named files aren't destroyed by New; they're saved and Basic pointers are moved to empty RAM.

You can be working on a Basic program, go to a text file and write, and return to your Basic program that is exactly as you left it.

Which brings up the interesting point of how the computer works. When you load a file into Basic, it isn't moved from its current position in RAM. Instead, pointers in Basic are set up to tell Basic where in memory the file sits, and where there's empty RAM for Basic variables, arrays, and other data.

This means that, unlike a disk system, you are always operating on the file in memory, not on a duplicate that's been loaded from storage into Basic. This gets hairy at times and points out a major flaw in this type of system: You can't save a file twice from Basic.

Say you're working on a program called "TEMPA" and you want to save it under a new name so you can edit it without risking it. You can't save it as a Basic file. Instead, you have to save it as an ASCII file, which takes up more memory than a Basic file (untokenized versus tokenized), and memory is at a premium in an 8K system.

This leads to another problem. After you've finished with "TEMPA" and you want to work on "TEMPB", the ASCII file, you have to make sure you have enough room in RAM for a third program.

ASCII files aren't loaded into Basic; they're duplicated into Basic as tokenized programs! Thus you have "TEMPA", an ASCII file, "TEMPB", your new program, and a tokenized version of "TEMPA" in Basic. This is all fine and good if "TEMPA" is a small program, but if it's 2K, and "TEMPB" is 2K, you won't have enough room left in an 8K computer to load "TEMPA" into Basic. (Remember, you only have 5,460 free bytes, less if you have an address and/or schedule file set up.)

The only solution is to save your precious program on tape, a quick procedure at 1500 baud, fortunately.

Another drawback to the operating system is that you have no way to determine the length of RAM files. However, it took me only an hour or two to figure out a simple Basic program to do that.

Manual

The manual is a well-written, spiral-bound, 224-page book. It lies flat and measures 8½ inches by 11 inches. It's fairly thorough, but some of the examples are too short to be informative and it's marred by several sins of omission. For example, the command ASC(x) isn't listed although it's a valid Basic command.

The LCD is listed as an output device with no instructions on how to use it, just a list of commands. Similar problems are scattered throughout the book.

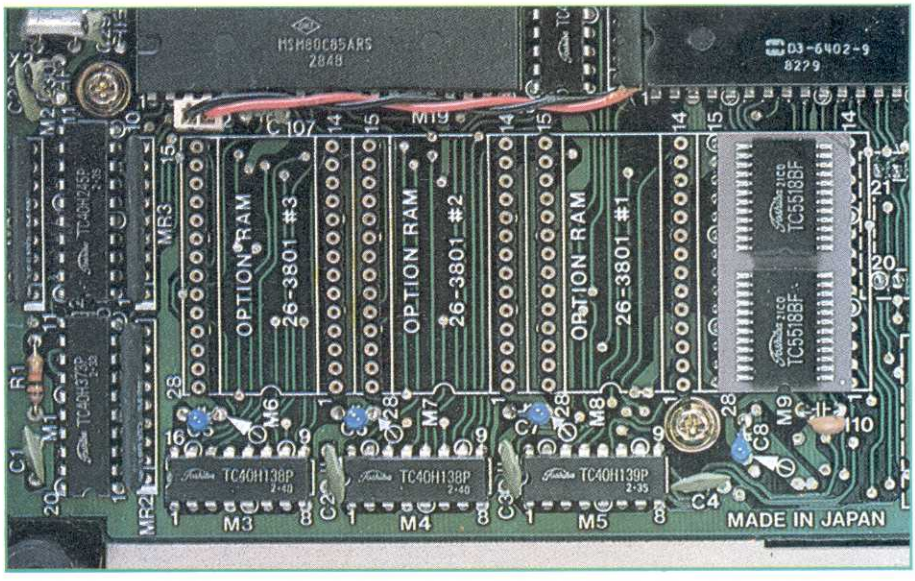


Photo 7. A section of the main circuit board, showing 8K RAM expansion sockets. Above, one 8K RAM module is in place at the far right center of the photo. Three additional 8K RAM module sockets are to the left.

The manual starts off with a brief explanation of how to use the Model 100 for text processing, telecommunications, scheduling, and as an address file. The explanations, while brief, are adequate. Then the manual goes into a description of Basic. Finally, a series of five appendixes gives the technical details on connecting Model 100 accessories, turning the machine on and off, sample work sessions, technical specifications, and maintenance information.

For the hacker, the specifications section is the most interesting since it gives the pin-outs for all the ports, including the expansion port on the unit's base. In addition, it has a display worksheet, character code tables, Basic error codes, and derived functions.

The last item is an index, which should have included the Basic commands but doesn't.

The manual is almost half as thick as the computer itself, but a small, totable, quick-reference guide booklet is provided. The booklet itself is over 50 pages long.

The Basic portion of the manual is definitely not designed for the neophyte. It consists of an alphabetical listing of almost all the Model 100 Basic commands. If you're a novice at Basic programming, you might have to buy a book explaining the commands.

Addresses	Use
0 - 32767	ROM
128 - 600	Basic keyword list
796 - 859	Basic error codes
916 - 1024	Cold start values for RAM
32768 - 40959	Fourth RAM chip (24K-32K)
40960 - 49151	Third RAM chip (16K-24K)
49152 - 57343	Second RAM chip (8K-24K)
57344 - 62960	First RAM chip (8K). Note you only have 5K.
62961 - 65535	Operating system overhead
63109 - 63358	Keyboard input buffer
63369 - 63496	Basic function keys
63369	Files
63385	Load "
63401	Save "
63417	Run
63433	List
63449	(blank)
63465	(blank)
63481	Menu
63498 - 63625	Duplicate of 63369-63496
63841 - 64128	Menu display
63841	BASIC
63853	TEXT
63864	TELCOM
63875	ADDRSS
63886	SCHEDL
63897	Suzuki Hayashki
63908	Available (blank)
64904 - 64927	Menu Time Display
65024 - 65343	RAM duplicate of LCD
65344 - 65535	Telcom video buffer

Fig. 1. A rather primitive memory map, but more than you get from Tandy.

Accessories

Model 100 accessories currently available include a power supply ($5.95), a direct-connect modem cable with one hour of CompuServe and Dow Jones connect time ($19.95), a printer cable ($19.95) that fits any Radio Shack parallel printer, and 8K RAM upgrades ($119.95 plus $15 installation). A hard-shell carrying case is not yet available.

For the businessman interested in leasing and maintenance, service contracts are available for the Model 100 (see Table 1).

Lease Costs
(minimum purchase must total $1600)

Computer	Lease/machine
M100 8K version	$27.90/month
M100 24K version	$34.86/month
8K upgrades (each)	$ 4.19/month

Service Contracts

Machine	Lease customers	Non-lease
M100 8K	$6.11/month	$79/yr
M100 24K	$8.25/month	$99/yr
8K upgrades (each)	$1.00/month	$12/yr

(Lease customers are leasing the M100)

Table 1. The lease figures listed are based on the formula (Lease = .03492 times purchase price) for monthly payments. Subject to change at the whim of Tandy.

Basic

As I mentioned earlier, the real power of the Model 100 lies with its firmware. All the files in RAM and the hardware in the machine are available to the programmer. If you'll look at Table 2 you'll see many commands added to the standard Microsoft Basic to take advantage of the Model 100's special features.

The design and treatment of the I/O is exceptionally open-ended. The same I/O commands are used for all the different input and output devices (see Table 3). That is, the command Input# inputs data from the cassette port, the modem, the RS-232, and from RAM files. The command Print# sends data to the cassette, the modem, the RS-232, the RAM, the LCD, and the printer.

The difference is in how the file buffer is opened, as a CAS, MDM, COM, RAM, LCD, or PTR buffer. (Although they don't mention it in the manuals, one of the devices used for I/O is DSK—a disk drive perhaps?) You can even use the Run command to load and run a Basic program from the modem, the RS-232 port, or tape cassette ports.

Making the Basic even more powerful are the ON...GOSUB commands. While running a Basic program you can set up subroutines to handle interrupts from the modem, the RS-232, function keys, and internal clock. That's right, you can put a specific time in the ON...GOSUB statement, and when that time arrives, the program branches to the subroutine automatically!

Another handy feature is the Files command, which displays the file names currently in the menu. If you happen to be using one of the Basic programs, it's indicated by an asterisk at the end of the file name. The Files command can even be included in a program.

Microsoft decided to use the text processor they already had, Text, rather than write a new one just for the 100's Basic. So you can edit a line, a group of lines, or even your whole program just by typing Edit and giving line numbers.

Since you're in the text editor and all the text commands are available to you, you can move lines, merge lines, split lines, and make any other changes you want.

When you're finished, press the F8 key and your alterations are merged back into your program. If you've improperly formatted your edited lines, the Model 100 beeps and remains in the text editor (I'll tell you more about the text editor in a moment).

This warning system doesn't always work, though. When I tried to combine four Basic lines into one, the combined line never made it back into Basic. Although I tried several times, the result was always the same, no original or merged lines in Basic. I still haven't figured out why this happened since I've successfully merged other lines.

Model 100 Basic does have a few disadvantages: It can't do hexadecimal or octal base arithmetic, there's no Auto Line-number command and no Delete command, and the largest line number allowed is 65529 (the manual doesn't mention this anywhere; I discovered it through trial and error).

I also found one serious flaw in Basic: In If...Then...Else statements, if the command Else is misspelled you get no error messages. I discovered this when I had an If...Then statement with the Else at the end of the display line. The Else was misspelled ELSRETURN, with the Return on the next line. Not only didn't I get an error message, the Return was ignored. It took many hours of hard searching to track down the error.

"The word processor included with the Model 100 is a sharp little program."

Model 100 Basic has another little idiosyncrasy: Sending PRINT to the display doesn't automatically clear each line. That is, if you fill the display with information, then send "PRINT@0," ":PRINT:PRINT:PRINT", you don't get the first four lines of the display cleared, as you do with the Models I/II/III/12/16 and the Color Computer. The only way to clear a line is to use the PRINT@ statement with the STRING$ statement to send a batch of blank spaces to the display to clear the required number of lines.

There may be many interesting things the display can do, but they aren't listed anywhere in the manual. For example, typing PRINTCHR$(27);"p" makes everything sent to the display appear as reverse characters (white on black). To switch back, type PRINTCHR$(27)"q". These must be lowercase letters, although I don't know why.

Text Processor

The word processor included with the Model 100 is a sharp little program. It's character-oriented and provides most of the important features desired by writers. You can move, duplicate, and delete by the character, word, line, or sentence, everything on the display be-

Table 2. Basic keywords. Note the interrupts allowed from the RS-232, modem, and time feature. Not listed in either the quick reference guide nor the manual are the two commands DSKI$ and DSKO$. I wonder what they could be for?

Command	Definition
ABS	Get absolute value of number.
ASC	Get ASCII code for character.
ATN	Arctangent function.
BEEP	Generates a "beep".
CALL	Calls M/L routine, passes values to A HL reg.
CDBL	Converts numbers to double precision.
CHR$	Returns ASCII character for number.
CINT	Truncates decimal number to integer.
CLEAR	Clears string space; sets high memory.
CLOAD	Load a Basic program from tape.
CLOAD?	Verify a Basic tape program.
CLOADM	Load a M/L program from tape.
CLOSE	Close open data files.
CLS	Clear Screen.
COM	Enable/Disable communications (RS-232) from Basic.
CONT	Resumes program execution.
COS	Cosine function.
CSAVE	Save a Basic program to tape.
CSAVEM	Save a M/L program to tape.
CSNG	Convert a number to single precision.
CSRLIN	Returns verticle cursor position.
DATA	Defines a data set in a program line.
DATE$	Set or display current date.
DAY$	Set or display current day.
DEFDBL	Define double-precision variables.
DEFINT	Define integer variables.
DEFSNG	Define single-precision variables.
DEFSTR	Define string variables.
DIM	Define array size.
EDIT	Edit a Basic program, line, or range of lines.
END	End program execution.
EOF	Test for end of file.
ERL	Get line number of last error.
ERR	Get number code for last error.
ERROR	Simulate an error.
EXP	Exponent.
FILES	Display all file names in menu.
FIX	Truncate real numbers.
FOR...TO... STEP...NEXT	Establish program looping.
FRE	Free memory space.
GOSUB	Call a Basic subroutine.
GOTO	Transfer program execution.
HIMEM	Get highest memory address available to Basic.
IF...THEN...ELSE	Conditional test expression.
INKEY$	Scan keyboard once.
INP	Input from a port.
INPUT#	Input data from a file.
INPUT$	Input a given number of characters from either the keyboard or from a file.
INSTR	Search a string for a substring.
INSTR	Replace a substring with another.
INT	Get whole number from real number.
IPL	Define warm start program.
KEY	Enable/Disable/Define a Basic function keys.
KEY LIST	List current function key definitions.
KILL	Delete a RAM file.
LCOPY	Copy screen to line printer.
LEFT$	Return left portion of a string.
LEN	Return length of a string.

fore or after the cursor, and everything in a file before or after the cursor.

The cursor is moved around the file by using the arrow buttons in conjunction with the shift and control keys. Shift/left arrow and shift/right arrow move the cursor to the beginning of either the previous word or the next word.

Shift/up arrow and shift/down arrow move the cursor to the top and bottom of the display, and if pressed again will page through your file, seven lines at a time (not eight because the cursor line is repeated on the new display). If you have the function key labels displayed, the paging is in groups of six lines.

The control key, when used with the arrow buttons, moves the cursor to the appropriate side of the display, or to the beginning or end of your file. As a result, moving around your file is fairly easy and fast.

The special function buttons are predefined as:

- Load, for loading files;
- Save, for saving files;
- Copy, for copying text into the Paste buffer for duplicating elsewhere;
- Cut, which cuts text out of your file in the Paste buffer, and stores it in the Paste buffer for moving elsewhere or deleting; and
- Menu, for returning to the same.

The Paste buffer is interesting. When you select a section of text to put in the Paste buffer, the text is duplicated into available RAM. Of course, you need sufficient room in the buffer for the entire text string, unless you use Cut to move the text into the buffer.

Additional room isn't necessary with Cut since you're moving the text from your file into the buffer and not duplicating it. What makes the Paste buffer so useful is that you can store text from one file and put it into another, even a Basic program. However, running a Basic program wipes out any text stored in the Paste buffer.

The Paste buffer has another drawback: You have to remember to clear it out if you need more room for text. Deleting 8K of text just moves it to the buffer. It still occupies 8K until you load the Paste buffer with another, shorter text string.

CLOSE file number
EOF(file number)
INPUT#file number,
INPUT$(numeric expression, file number)
LINEINPUT#
LOAD
LOADM
MERGE
OPEN
PRINT#
PRINT#USING
RUN
RUNM
SAVE
SAVEM

Table 3. Common I/O Commands. Note that not all devices will respond to these commands; for example, you can't input from the LCD.

Using Text is simple. Just load a file and start typing. You're always in insert mode, so the current cursor position marks where new text is added.

The keyboard is interrupt-driven and won't lose any keystrokes no matter how fast you type. It's a little disconcerting to look up after quickly typing several sentences and watch the display

LET	Assignment statement (optional).
LINE	Draw a line (dot graphics).
LIST	List program on display.
LLIST	List program on line printer.
LINEINPUT#	Input a string from a file.
LINEINPUT	Input a string from the keyboard.
LOAD	Load a Basic program (can be from RAM, CAS, COM, or MDM).
LOADM	Load a M/L program (RAM or CAS).
LOG	Natural logarithm.
LPOS	Line printer column position.
LPRINT	Print data on line printer.
MAXFILES	List or set current number of files.
MAXRAM	Lists current memory size.
MDM	Enable/Disable interrupts from modem to Basic.
MENU	Exits Basic.
MERGE	Merges ASCII program with current program (can be from RAM, CAS, COM, or MDM).
MID$	Get/Replace middle characters of a string.
MOTOR	Turn cassette motor on/off.
NAME...AS...	Rename a RAM file.
NEW	Erase current program from Basic buffer.
ONCOMGOSUB	Define Communication interrupt.
ONERRORGOTO	Define Error interrupt.
ONKEYGOSUB	Define Function Key interrupt.
ONMDMGOSUB	Define Modem interrupt.
ONTIME$GOSUB	Define Clock interrupt.
ON...GOTO	Branch on expression.
ON...GOSUB	Branch on expression.
OPEN	Open a file for I/O.
OUT	Output a byte to a CPU port.
PEEK	Get a value directly from memory.
POKE	Load a value directly into memory.
POS	Get column position of cursor.
POWER	Define time to Automatic power off.
POWER OFF	Turn power off (in program).
PRESET	Turn off x,y pixel in display.
PRINT	Print data on display.
PRINT#	Print data to a file.
PSET	Turn on x,y pixel in display.
READ	Read values from a Data list.
REM	Comment line.
RESTORE	Reset the data statement pointer.
RESUME	Continue execution after an error, or after power is turned back on (after a POWER OFF command).
RETURN	Ends subroutine of GOSUB.
RIGHT$	Return right portion of a string.
RND	Return a random number between zero and one.
RUN	Execute a Basic program.
RUNM	Execute a M/L program.
SAVE	Save a Basic program (to RAM, CAS, COM, or MDM).
SAVEM	Save a M/L program to RAM or CAS.
SCREEN	Lock/Unlock display of function key labels.
SGN	Algebraic sign.
SIN	Trigonometric sine function.
SOUND	Enable/Disable/Output a tone (1 to 16383).
SPACE$	String of spaces.
SQR	Square root function.
STOP	Halt Basic program execution.
STR$	Convert a number to a string.
STRING$	Define a string of characters.
TAB	Skip space on printing.
TAN	Trig. Tangent function.
TIME$	Set/Display current clock time.
TIME$	Enable/Disable time interrupt.
USING	Format data to be printed.
VAL	Convert strings to numbers.
VARPTR	Get address of variable.

catch up to what you were typing.

The constant insert takes a little getting used to. If you make a mistake, you can't go back and type over it; you have to delete a character every time you type a correction. I usually just back up over the errant character, type the correction, and continue typing, letting all the bad keystroke characters pile up in front of the cursor.

When I'm done with the sentence, I delete the whole batch of accumulated errors. This only works if I catch the mistake as soon as I type it; otherwise I have to go back through the text and remove typos.

There is a backspace key that erases the character you've just typed, but I always forget about it, silly though that is.

The only other commands available are for printing your file. The Print button is used to either print the display or print your entire file. When the Print button is pressed, you're prompted for the line width of your printer, and then the Model 100 starts sending characters to the printer.

There are no printer formatting commands, but you can embed printer control commands in your text by using the control key. This lets you take advantage of any special printer functions your printer may have, such as underline or boldface.

The lack of printer formatting commands isn't as bad as it sounds, since you can write a simple Basic program that formats your printed file. As a matter of fact, the manual has a short program in the appendix that paginates your file every 56 printed lines and prints a page title with the time and date. It won't take much skill to add to the program so it indents paragraphs, prints page numbers, centers lines, and so forth.

The text processor also doesn't have global search and replace functions, multiple block definition for altering text, optional windowing of text (so you can see what text formatted for a 60-column page would look like), and macro definitions.

Telecom

As I mentioned before, the communications hardware is impressive, including a standard RS-232 connector, a direct-connect (for modular plugs) auto-dial modem, and an acoustic modem. One slide switch controls answer or originate mode, and another selects acoustic or direct-connect modem hardware.

"The communications hardware is impressive, including a standard RS-232 connector, a direct-connect auto-dial modem, and an acoustic modem."

Both the acoustic and the direct-connect modems use the same receptacle on the top of the Model 100. To use the direct-connect modem, you have to use the modem cable with the modular plug and female connector on it. After plugging the cable into the computer, plug the male plug into the wall socket, and your phone's modular plug into the cable's female connector. Now the computer is between your phone and the wall socket, and can directly intercept or place phone calls.

The acoustic modem uses a cable with rubber cups that accept the phone's handset. You can use any standard phone handset with the acoustic modem, even those on pay phones.

When you select Telcom from the menu, you're told the current baud rate, word length, stop bits, and parity. You can change these settings by typing Status followed by the new conditions (F3 prints Status for you). F1 searches through the address file to match a character string you type in (such as CIS for CompuServe). It displays the number so you can use the auto-dial feature or dial it yourself.

Pressing F2 makes the 100 dial the number you've indicated. If you want to tie into a computer network, leave the phone hook down and the 100 automatically goes on-line. If you want to talk to someone, lift the handset before the 100 finishes dialing and you'll be put in voice mode when the computer finishes dialing.

F4 puts you in terminal mode, and F8 returns you to the menu.

People Are Talking

by John P. Mello Jr.
***80 Micro* News Editor**

From market analysts to hungry competitors Tandy's book-sized Model 100 micro has attracted accolades, and some observers maintain the Micro Executive Work Station (MEWS) may be the elbow grease the Forth Worth firm needs to polish its ailing image.

"I think it's a very attractive machine," observed Aaron C. Goldberg, research manager for information systems at International Data Corporation in Framingham, MA.

Alex D. Stein, an industry analyst with Dataquest in Cupertino, CA, added, "It is the embodiment of the user friendliness that the market is requiring more and more [these days]."

Clive Smith, a senior analyst with The Yankee Group in Boston, commented, "It's the first real portable incorporating a substantial flat screen into the computer. It's only eight lines—obviously a full page would have been better—but it is a significant step. With further enhancements, which I expect Tandy to introduce, I expect the product to do very well for them."

David Hughes, publisher of Sourcetrek Magazine on The Source and a leading figure in the Network Nation, also found the 100's screen a drawback, but still praised the micro. "It looks damn good to me," he said. "A chunk of text 8 by 40 is small for a writer, but it does feel like I'm writing and not just getting a data stream in."

"The 100," he said, "fills a real gap between the hand-held and Osborne level portables."

He explained: "Time after time, I'm at some meeting and I want to take running notes and access information in my system by dialing it up without being obtrusive. I've literally taken an Osborne into a meeting, sat in the back of a room, and used it for note taking. It works, but it's awfully awkward."

For John Hemphill, a product analyst for Future Computing in Richardson, TX, the 100 exploited what manufacturers of other "portables" ignored:

"The technology to do this has been around for quite some time, but manufacturers have been slow in putting it out. People that put out portable computers in the past really didn't make them portable and really didn't make

In terminal mode the function buttons are redefined. The first one is used to toggle between the previous eight-line display and the current one, giving you a total of 16 display lines. F2 saves incoming data in a RAM file. F3 ships a RAM file out (when enabled, the labels for F2 and F3 appear in reverse video).

F4 toggles the unit between half- and full-duplex operation, F5 sends incoming data to both the display and your printer, and F8 takes you out of term mode (but it asks if you want to disconnect before it does so).

The auto-dial feature has another important use. When you're signing onto a computer database, it automatically sends any log-on messages you want, including user ID numbers and passwords.

To facilitate its use, and to prevent someone from watching you auto-dial to a service and seeing your ID passwords, you can enclose the important information in greater-than and less-than symbols ("<" and ">") in the address file, instructing Telcom not to display this information when you use the FIND and CALL function keys.

Overall, Telcom is a simple and easy-to-use system.

That is not to say that Telcom is perfect. It isn't. There's no echo function, so the Model 100 doesn't echo received characters back to the transmitting computer. There's also no automatic line feed when a carriage return is received. This presents problems when communicating between Model 100 computers.

Every time you hit enter, you have to remember to hit control-J or the cursor returns to the beginning of the line, obliterating the line with new, incoming information. Another disadvantage is that there isn't automatic file capture: Sending control-R to a Model 100 doesn't automatically open a storage buffer for an incoming file.

Speaking of buffers, you have no way of knowing the size of your available text buffer. Your only choice is to check the menu for available RAM before you go into Telcom. If you should run out of RAM while receiving a file, the Model 100 beeps once and the download indicator (F2) returns to normal video from reverse video.

Uses

Business executives will find the Model 100 a boon to their work. They can prepare reports and charts, enter and analyze data, and download information from data bases, no matter where they are, a car, bus, private plane, or train. Where you would normally waste time, you can now use a portable computer to take advantage of otherwise enforced idleness.

With the expansion ROM socket, Radio Shack will soon have a more powerful word processor available, and I've heard they're working on an electronic spreadsheet for the 100 as well.

Salesmen and their managers will find the Model 100 worth its weight in gold. A salesman can prepare daily sales reports in the field and transmit them to headquarters at the first opportunity. Or he can write up sales orders on the 100 and save them in RAM. At day's end, the salesman calls the home office from his motel room or a public phone, and uploads all the day's sales.

Review continues

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them battery-powered."

"One of the strong points of this machine," he said, "is the communications interface. It shows [Tandy] understands the importance of the communications-computer relationship."

Even Tandy's competitors admit the Fort Worth firm's MEWS is a winner.

"It's a pretty nifty little system," noted Mike Kennedy, marketing vice president for Grid Systems Corporation of Mountain View, CA. Grid makes a folio-sized computer selling for more than $7,000.

An executive at a Japanese computer firm rumored to be preparing a market challenge to the 100 told *80 Micro* he purchased a MEWS the day it came out. He explained, "I had to call four or five Radio Shack stores to find one."

"I think it's a great product!" he declared. "I think they did a good job the first time through."

He added, "The way this product came together is the way things should go. You have the best of Japanese technology, Radio Shack's product definition, and Microsoft's software capability combining to make a nice product."

When interviewed about the 100, Herb Feinstein, director of marketing for the Teleram Communications Corporation in White Plains, NY, praised MEWS because it would improve the market for his firm's $2,995 book-sized micro. "We like the fact [Tandy's] introduced it," he said. "We think it's going to expand the market and bring more attention to portable computers."

Walt McIntyre, national sales manager for Epson of America, agreed with Feinstein about Tandy's entrance into the book-sized market: "I think it will help this whole segment of the business. They're a recognized name. Even though Epson is a world leader in printer and LCD manufacturing, the name is not associated with the same strength with microcomputers. It's a blessing on the concept."

"I think it looks good," Access Computer Corporation's Marketing Vice President Harry White said of the 100, "but it's not really in the same market we're in."

White's San Jose firm makes an Osborne-sized micro that comes with a printer, two types of modems, lots of software, and weighs more than 30 pounds with its power pack (see *80 Micro*, May 1983, p. 350).

"No one," he contended, "is going to do data-base management or word processing or spreadsheet analysis in any serious way on the little Radio Shack."

But on the contrary, some very serious computing may soon be done on the 100, according to Steve Leninger, the father of the Tandy's Model I and Color Computer. Leninger, who recently returned to Tandy after a brief stint as a consultant, maintained: "My personal feeling is it's going to be another Model I—a popular machine with a lot of independent software being written for it. I think a giant amount of software will be written for it."

But the 100 is more than just a new machine for Tandy. Not only does it represent one of the largest investments in the firm's corporate history, but it may resuscitate what some experts see as Tandy's flagging image in the microcomputer market.

"I think it's important," IDC's Goldberg said of the 100, "because Tandy's market share's declined significantly. There's a lot of luster off the Tandy brand-name and a lot of people don't care who they are any more."

"To be quite honest, other announcements were pretty ridiculous," he opined. "Now we see they're in the market for real. The price [of the 100] is competitive and they're back in a new part of the marketplace."

Stein of Dataquest, though, disagrees with Goldberg's analysis of Tandy's image.

News story continues

Review continued

The following morning, the manager prints out all the salesmen's reports on the office computer and prepares a summary report for the boss. This can be done with a Model III and currently available BBS software (such as Connection-80 or Forum-80).

With minor modifications, the home-office computer could be programmed to print confirmation orders to mail to customers contacted by the salesmen. The net result: next-day accuracy on the status of your salesmen, up-to-date reports on inventory levels and the fastest-selling items, and the ability to leave messages on the company's BBS, both for general product information and for specific salesmen.

In today's market, daily information on sales and product activity can make or break a company. The Model 100 gives companies access to that information at a modest cost per salesman.

Writers will love the freedom the computer gives them. Up to now, most writers have been limited to writing with typewriters. Even the small portables are difficult to deal with. You need paper and a place to set it up. And they're noisy.

After you've finished a page, you have to either retype the page or literally cut it up for revisions. And if you aren't near a wastepaper basket while typing, what do you do with all the paper you've wasted?

With the new Model 100, your compositions are easily revised. When you have a finished draft, you can save it to tape for later printout. Newspaper reporters will also find it useful for remote reporting, uploading the finished copy to the newspaper's computer. No more rushing back to the office, or calling it in over the phone.

"In conclusion, I think the Model 100 is the best computer to appear on the market in a long time."

Students can use the machine for term papers and reports. All they need is a printer, and I'm sure some bright soul will set up a printer rental operation on campus.

Miscellaneous Comments

Tandy's advertising implies you can use the Model 100 in an airplane; the computer's box even has a picture of an executive working in flight. Unfortunately, you may not be able to use the Model 100 on a commercial airplane (see p. 169 for the lowdown on in-flight use of the 100).

Another potential problem is the use of power supplies. Radio Shack, and many other companies, sell 6V dc power supplies for toys and games. These supplies should not be used with the Model 100 because they don't provide any line-current or voltage-filtering protection. The CMOS chips inside the Model 100 are extremely sensitive, so using these other power supplies could eventually ruin your Model 100. Use only the power supply made by Radio Shack expressly for the Model 100. At $5.95 you can't say they're trying to get more money out of you for their computer.

In conclusion, I think the Model 100 is the best computer to appear on the market in a long time. While disk drives aren't immediately available, they are on the way. In addition, I know someone who's developing a 128K battery-powered bubble-memory device that plugs into the Model 100. It should be ready by September.

Considering what you get for the price, the Model 100 is a great computer. I'm sure many copycat computers will appear on the market, trying to cash in on the boom.

If you're looking for a portable computer, and can do without CP/M and disk drives for now, buy the Model 100. I don't think you'll regret it. ■

News story continued

"I don't think Tandy is in decline at all," Stein said. "I think we see Tandy losing market share because the market is growing and competition is coming in. We're not really seeing them suffering. Financially, they're still doing well. They're profitable."

However, the Dataquest analyst noted, "Tandy has made some decisions in distribution that have pretty much hindered their growing at the rate of the market."

On just how well the 100 may do this year, analysts differ.

Asked if Tandy could sell 300,000 units by the end of calendar 1983, Smith of Yankee responded: "That's plausible. We're not really talking about a lot of money here and we're talking about real utility. I think that's an achievable number."

Goldberg of IDC termed the 300,000 figure "a little high." He suggested the figure would be more around 200,000.

"It all depends on the acceptance of the product," he said. "It's hard to guess that people are going to go back to Radio Shack stores. This product may generate some interest in people, but, of course, it is not going to be available [outside Tandy stores]. I think that's going to hurt Tandy."

Dataquest's Stein also found the 300,000 figure high. "Even for a mass-market product like this, there's a ramp-up time," he said. "I think at the high end, they'll sell 150,000 units by the end of the year."

Predictions by Future Computing's Hemphill were even lower than Stein's. He said the under-$1,000, book-sized market for 1983 would be 65,000 units, Tandy having 25 percent of that or 15,000 to 20,000 units.

Although Access Marketing Vice President White also found the 300,000 figure high, he conceded, "It might be possible... It's not impossible, but it sounds aggressive."

Asked if the 100 would appeal to second- as well as first-time computer buyers, White said, "That's an interesting market for it. I wouldn't mind having one as a terminal for one of my other computers."

Sourcetronaut Hughes added, "You wouldn't necessarily use it as your first computer because it is a little limiting, but linked with other systems, it isn't. It's the water glass and you've always got the pitcher somewhere else."

With the release of MEWS, Tandy has taken an inside track on the book-sized market. Existing competitors are either priced outside the mass market or have fewer features than the 100. But be prepared for at least six new book-sized micros before the end of the year.

"My guess is the thing is going to take off real well and everyone is going to jump behind it," one industry executive surmised. And Clive Smith added, "Eighty-four will be when they face significant challenges from other computer makers. Look to Comdex this winter." ■

But Will It Fly?

by John P. Mello Jr.
***80 Micro* News Editor**

The Model 100 has been touted as the ideal micro for perking up life's dead spots—like long plane rides. But if you intend on computing while flying, beware! You're entering a regulatory morass.

When it comes to using electric gadgets on passenger planes, Federal Aviation Administration rule 91-19 bars them all—except tape recorders, hearing aids, pacemakers, and electric shavers—unless an airline approves the device.

Which devices have been anointed by the air carriers? A survey by *80 Micro* of six major airlines revealed none of them have a list of approved devices nor do they have a hard, fast rule on using portable computers on their aircraft.

"It is up to the airline to determine if the device interferes with the communication or navigation aids to the airplane," an FAA spokesman said. "Our belief now is that we don't think portable computers will do that."

Northwest and United spokesmen said their airlines allow computers to be used in flight.

"Generally," the United Airlines spokesman observed, "computers don't bother us as long as they can fit under the seat."

Matt Gonring of Northwest Airlines noted, "As long as the computer doesn't transmit anything or receive anything or cause any sort of interference with communications, then we don't have any restrictions on it. Being a relatively new technology, we haven't experienced any problems with it, and a lot of people have had computers on board."

In its flight guide, American Airlines warns passengers: "Portable radios, TVs, and some electronic toys radiate signals that may interfere with the navigation system so we must ask you not to use those in flight."

"We really haven't addressed the subject of computers," American spokesman Paul Haney admitted. "If somebody attempted to use one and there was a question, it would undoubtedly fall on the captain to decide if it would be a problem or not."

At TWA, spokesperson Sally McElwreath explained, "The policy is to let a passenger use the computer until the pilot perceives any interference."

Delta Airlines was emphatic about barring micros from its aircraft. "We cannot take a chance on the safety of that equipment," a spokesman for the airline said. "We can't take a chance on something going awry. If someone came aboard and set up shop, the flight attendant would probably ask them to discontinue."

Yet Richard Shaffer of *The Wall Street Journal* was on a Delta flight when he wrote: "This is being written in the air. . . . I'm testing a small computer designed to be used aboard airplanes and almost anywhere else." The small computer he was testing was the Model 100.

> *" 'Computers don't bother us as long as they can fit under the seat.' "*

"I have yet to have an airline stop me from using anything," Shaffer told *80 Micro*.

"I went to a lot of trouble because it was an unannounced product," he said. "I taped up the name and I masked all the ports and everything that could identify what it was.

"The only one to say anything to me was the guy sitting next to me on the plane. He said, 'Is that one of those minicomputers?' And I said, 'No.' "

"I don't see how it would be any different from using a calculator," Shaffer added. "It's the same circuitry inside."

But on Eastern Airlines, even calculators may be a target of prohibition. "At one time we allowed some electronic calculators, but since they've expanded, we've had to rule those out," said Dale Jones, manager of flight technical services for Eastern at Miami International Airport.

Asked what happens when a person tries to board the plane with a computer, Jones responded: "We try to keep them off. It's a little difficult to say it's enforced without exception. The flight attendants have been instructed to tell anyone using computers not to use them."

He maintained burdening airlines with regulating electronic devices creates problems. "The only way we can determine any individual device does not cause interference is to test that device on the aircraft that we fly," he said. "That's a long and very expensive process."

"We've had quite a bit of controversy over this," he continued. "We have in the past tried to take certain devices and evaluate them, but the expense and time involved was too much for us."

He added, "Our engineering department has received a number of electronic devices from manufacturers to evaluate, but we've just had to return them. We just can't do it."

Jones cited one instance where an aircraft missed a checkpoint allegedly because someone played a portable Pac-Man game on the plane. The pilot was convinced it was the game, Jones said, but "We can't prove it was Pac-Man. We tried to duplicate it on the ground and couldn't."

Richard Climie, director of avionics for the Airline Electronics Engineering Committee in Annapolis, MD, noted cases have been reported to his organization of devices causing systems on an aircraft to malfunction. He added, however, "I personally don't know of any case where this has created a safety hazard."

In one case, he said, a passenger used a radio telephone on a plane. "It caused an inconvenience to the passengers," he said. "It caused the system that controls the pressure to fluctuate and create discomfort in their eardrums."

Climie, who owns a Model I that "clobbers" TV channels at the lower end of the dial, noted: "Certainly things are better than in the days of the old Model I, but requiring each airline to approve the equipment is not a practical solution to the problem when we have so many devices."

One solution to what will become a growing problem as more and more book-sized totables enter the market is to have the FAA follow the lead of the Federal Communications Commission and adopt RFI standards.

"If they do that," Climie explained, "the testing could be done once. The units could be identified so it will be easy for the customer to know if he's buying something he can use on an airplane or not. It would not be ambiguous." ■

Model 100 Start-up Kit

What do you do with your new Model 100?
Here are seven programs to get you going.

Gas/Oil Mileage

by Beve Woodbury
***80 Micro* Technical Editor**

Once you buy a Model 100, you'll never travel without it. This program lets you keep a running average and overall average of your car's gas and oil consumption.

Begin the program when your gas tank and oil pan are full. Run Program Listing 1. This program asks for the brand of car and the current mileage. It then establishes the data file, "GASOIL.DO". Listing 1 may now be deleted.

Program Listing 2 prints a menu with three options: record purchase of gas and/or oil, print a miles-per-gallon chart, and print oil use.

The first option, purchase of gas/oil, prompts for the price per gallon of gas, the current mileage, and the number of gallons purchased. The total purchase price is printed. You are given the opportunity to reenter the data if it is incorrect. The miles-per-gallon (mpg) figure from the last tank of gas is printed. You are then asked for the amount of oil added. The program must be run again to record another purchase.

Option two, print miles-per-gallon chart, prints a chart with tank fill-up number, date of purchase, mpg, price per gallon, and the cost of gas per mile. The overall mpg average is also printed.

Option three (oil use) prints a chart of the fill-up number, purchase date, amount of oil added, and number of miles per quart of oil. The overall miles per quart is printed.

Each option returns to the menu. ■

Printing Formats:
- B–8 spaces
- E–3 decimal number
- F–2 decimal number

Arrays:
- D–dates of purchases
- Y–0, number of gallons purchased
- 1–price per gallon of gas
- 2–mileage
- 3–oil added

For . . . Next Loops:
- K and J

Decisions:
- A–data entered correct?
- H–add oil?
- U–purchases been run?
- Z–menu choice.

General:
- C–car name
- L–last array dimension number
- M–current mileage
- N–new array dimension number
- O–array location of oil purchase
- P–price/gallon of gas
- Q–number of gallons of gas purchased
- R–total gallons of gas
- S–miles/quart of oil
- T–miles per gallon
- V–number of quarts of oil added
- W–total quarts of oil added
- X–last tank miles per gallon

Table 1. GAS.BA Variables

Line	Description
10–40	Formatting
50	Prints date
60–70	Open data file & read car name, last fill-up number
80	Prints heading
90–160	Set up and fill data arrays
170–240	Print menu, execute choice
250–310	Enter gas purchase data
320	Calculates mpg of last tank
340–370	Enter oil purchase data
380–420	Add new data to arrays
430–490	Write data arrays to data file
500–590	Print mpg chart
600–700	Print oil usage chart
710–720	Return to menu routine
730	End

Table 2. GAS.BA Line Descriptions

```
10 PRINT@10,"SET UP ORIGINAL FILE"
20 PRINT@50," FOR GAS & OIL USAGE
30 PRINT
40 OPEN"RAM:GASOIL.DO"FOROUTPUTAS1
50 INPUT"ENTER NAME OF CAR ";C$
60 PRINT
70 INPUT "ENTER CURRENT MILEAGE ";M
80 PRINT#1,C$;",";"0";",";M
90 CLOSE:END
```

Program Listing 1. ORIG.BA

Program Listing 2. GAS.BA

```
10 CLEAR
20 REM * GAS AND OIL MILEAGE *
25 REM     BY BEVE WOODBURY
30 DEFSTRA-H:B=SPACE$(8):F="#####.##"
40 E="####.###"
50 CLS:PRINT@50,DATE$:PRINT
60 OPEN"RAM:GASOIL.DO"FORINPUTAS1
70 INPUT#1,C,L:N=L
80 PRINT"GAS AND OIL USAGE FOR "C:PRINT
90 DIMDD(L+1),Y(L+1,3):INPUT#1,Y(0,2)
```

Listing 2 continues

Listing 2 continued

```
100 IFL=0THEN160
110 FORJ=1TOL
120 INPUT#1,D(J)
130 FORK=0TO3
140 INPUT#1,Y(J,K)
150 NEXTK:NEXTJ
160 CLOSE:GOTO 710
170 CLS:PRINTB;B;"MENU":PRINT
180 PRINTB;"1. PURCHASE OF GAS / OIL"
190 PRINTB;"2. PRINT MILES PER GALLON CH
ART"
200 PRINTB;"3. PRINT OIL USAGE":PRINT
210 INPUT"ENTER # OF YOUR CHOICE";Z
220 IFZ=1ANDU=1THENCLS:PRINT:PRINT"PRESS
 <F4> FOR MORE ENTRIES":END
230 IFZ>4ORZ<1THENCLS:GOTO170
240 ONZGOTO250,500,600
250 CLS:N=N+1:INPUT"PRICE/GALLON OF GAS"
;P
260 INPUT"CURRENT MILEAGE";M
270 INPUT"NUMBER OF GALLONS PUCHASED";Q
280 PRINT "COST SHOULD BE";:PRINTUSING"$
$###.##";P*Q:U=1
290 INPUT"IS DATA ENTERED CORRECT? Y/N";
A
300 IFA="Y"GOTO320
310 IFA="N"GOTO250ELSE290
320 X=(M-Y(L,2))/Q:PRINT
330 PRINT"LAST TANK AVERAGED";:PRINTUSIN
G"###.##";X;:PRINT" MPG":PRINT
340 INPUT"ADD OIL Y/N";H
350 IFH="Y"GOTO370
360 IFH="N"GOTO380ELSE340
370 INPUT "HOW MANY QUARTS OF OIL ADDED"
;V
380 D(N)=LEFT$(DATE$,5)
390 Y(N,0)=Q
400 Y(N,1)=P
410 Y(N,2)=M
420 Y(N,3)=V
430 OPEN"RAM:GASOIL.DO"FOROUTPUTAS1
440 PRINT#1,C;",";N;",";Y(0,2)
450 FORJ=1TON
460 PRINT#1,D(J)
470 FORK=0TO3
480 PRINT#1,Y(J,K)
490 NEXTK:NEXTJ:CLOSE:GOTO710
500 CLS:PRINT"TANK  DATE    MPG     $/GA
L  $/MILE
510 FORK=1TON
520 T=(Y(K,2)-Y(K-1,2))/Y(K,0)
530 PRINTUSING"###";K;:PRINT"  ";D(K);:P
RINTUSINGF;T;:PRINTUSINGE;Y(K,1);
540 IFT=0THENPRINTUSINGE;TELSEPRINTUSING
E;Y(K,1)/T
550 R=R+Y(K,0)
560 NEXTK
570 PRINT:PRINT"OVERALL MPG AVERAGE IS -
 ";
580 PRINTUSINGF;(Y(N,2)-Y(0,2))/R
590 GOTO710
600 CLS:PRINTB,"OIL USAGE":PRINT
610 FORK=1TO1000:NEXT
620 PRINT " TANK    DATE    QTS/OIL   MI
LES/QT"
630 FORK=1TON
640 IFY(K,3)=0THEN680
650 W=W+Y(K,3):S=(Y(K,2)-Y(O,2))/Y(K,3):
O=K
660 PRINTUSING"####";K;:PRINT"     ";D(K
);:PRINT"     ";Y(K,3);"     ";
670 PRINTUSINGF;S
680 NEXTK
690 PRINT:PRINT"AVERAGE MILES/QUART OF O
IL -";
700 PRINTUSINGF;(Y(N,2)-Y(0,2))/W
710 PRINT:PRINT"PRESS ANY KEY FOR MENU"
720 IFINKEY$=""THEN720ELSE170
730 END
```

Traveling Expenses

by Beve Woodbury
***80 Micro* Technical Editor**

This handy program cumulatively records all your travel expenses so you'll know if you are getting close to or going over budget. It can also provide a printout of your expenses.

Running the Program

Set up a new expense account file by running Listing 3. Run this program only to establish a new expense file.

Choose the appropriate option from the menu by entering the corresponding number. A pause occurs after the first menu while the computer reads the old file and prints the new one. Answer prompts as they appear—name, amount, dates, comments. Be as brief as possible in your answers. Do not include commas in your data.

The travel option provides two suboptions—automobile and other. When you choose the automobile option, the program requests mileage. Enter the mileage you have driven and the program prints the charge. (The charge-per-mile is set at twenty cents. You can change it in line 140.)

Always end the program by going to the totals-end menu. This step prepares the file for your next trip. If you don't do this, you may lose your data file.

The totals menu totals expenses for

Program Listing 3. ORIG.BAII

```
10 CLS:DEFSTR G-Z:G="######,.##"
20 OPEN"RAM:EXPFIL.DO"FORINPUTAS1:OPEN"R
AM:EXPNEW.DO"FOROUTPUTAS2:INPUT#1,K:PRIN
T#2,K
30 CLS:PRINTTAB(10)"MENU":GOSUB430:PRINT
TAB(5)"6. TOTALS OR END"
40 INPUT"ENTER # OF YOUR CHOICE: ";D
50 IFD<6THENDD=1:GOTO70
60 IFD=6ANDDD=1THEN180ELSE200
```

Listing 3 continues

Decisions:	
D	Menu choice
DD	Has EXPFIL been rewritten to EXPNEW
H	Hardcopy
J	Travel—automobile or other
V	Miscellaneous or specific total
General:	
A	Category accumulator
B	Grand total accumulator
C	Charge
E	Automobile mileage
F	Misc. special category accumulator
G	Hardcopy number print format
K	Start character of file
L	Category indicator to search for
N	Name
P	Special miscellaneous category
U	Read EXPFIL and write EXPNEW
X	Comments
Y	Dates
Z	Category indicator

Table 3. ORIG.BAII

Listing 3 continued

```
70 IFEOF(1)THEN90
80 INPUT#1,U:PRINT#2,U:GOTO70
90 ONDGOTO100,110,120,130,170
100 CLS:INPUT"HOTEL NAME";N:Z="H":GOTO41
0
110 CLS:INPUT"RESTAURANT NAME";N:Z="M":G
OTO410
120 CLS:INPUT"ENTERTAINMENT NAME";N:Z="E
":GOTO410
130 CLS:PRINTTAB(17)"TRAVEL":PRINT:INPUT
"AUTOMOBILE OR OTHER? A/O: ";J
140 IFJ="A"THENINPUT"MILEAGE: ";E:C=E*.2
0:PRINT"CHARGE IS ";C:N="AUTO":GOTO160
150 INPUT"MEANS OF TRANSPORTATION ";N:IN
PUT"CHARGE";C
160 INPUT"DATE";Y:INPUT"COMMENTS";X:Z="T
":GOTO420
170 CLS:PRINTTAB(10)"MISCELLANEOUS":PRIN
T:INPUT"MISC. CATEGORY NAME";N:Z="S":GOT
O410
180 CLOSE: KILL"EXPFIL.DO":NAME"RAM:EXPN
EW.DO"AS"RAM:EXPFIL.DO"
190 CLS:A=0:B=0:L=" ":V=" ":P=" ":OPEN"R
AM:EXPFIL.DO"FORINPUTAS1:INPUT#1,K
200 PRINTTAB(12)"TOTALS FOR:":GOSUB430:P
RINTTAB(5)"6. GRAND TOTAL       7. END"
210 INPUT"ENTER # OF YOUR CHOICE: ";D
220 IFD=7THEN:END
230 INPUT "DO YOU WANT A HARD COPY? Y/N:
";H:IFH="Y"THENLPRINT:LPRINT
240 ONDGOTO250,270,290,310,330,380
250 CLS:PRINT"CALCULATING LODGINGS TOTAL
":PRINT:IFH="Y"THENLPRINT"LODGINGS:":LPR
INT
260 L="H":GOSUB450:PRINT"LODGING TOTAL="
;A:INPUT;G:GOTO190
270 CLS:PRINT"CALCULATING MEALS TOTAL":P
RINT:IFH="Y"THENLPRINT"MEALS:":LPRINT
280 L="M":GOSUB450:PRINT"MEALS TOTAL=";A
:INPUT;G:GOTO190
290 CLS:PRINT"CALCULATING ENTERTAINMENT
TOTAL":PRINT:IFH="Y"THENLPRINT"ENTERTAIN
MENT:":LPRINT
300 L="E":GOSUB450:PRINT"ENTERTAINMENT T
OTAL=";A:INPUT;G:GOTO190
310 CLS:PRINT"CALCULATING TRAVEL TOTAL":
PRINT:IFH="Y"THENLPRINT"TRAVEL:":LPRINT
320 L="T":GOSUB450:PRINT"TRAVEL TOTAL=";
A:INPUT;G:GOTO190
330 CLS: PRINT"ENTER M FOR MISCELLANEOUS
 TOTAL ":INPUT"ENTER S FOR TOTAL ON A SP
ECIFIC NAME ";V:IFV="M"THEN360
340 INPUT"CATEGORY NAME: ";P:PRINT:PRINT
"CALCULATING ";P;" TOTAL":IFH="Y"THENLPR
INTP":":LPRINT
350 PRINT:GOSUB450:PRINTP" TOTAL=";A:INP
UT;G:GOTO190
360 CLS:PRINT"CALCULATING MISCELLANEOUS
TOTAL":PRINT:IFH="Y"THENLPRINT"MISCELLAN
EOUS:":LPRINT
370 L="S":GOSUB450:PRINT"MISCELLANEOUS T
OTAL=";A:INPUT;G:GOTO190
380 CLS: PRINT"CALCULATING GRAND TOTAL":
PRINT:IFH="Y"THENLPRINT"TOTAL EXPENSE IS
: ";
390 GOSUB450:PRINT"TOTAL EXPENSE IS ";B:
INPUT;D:IFH="Y"THENLPRINTB
400 GOTO190
410 INPUT"CHARGE: ";C:INPUT"DATES: ";Y:I
NPUT"COMMENTS";X
420 -
430 PRINTTAB(5)"1. LODGINGS":PRINTTAB(5)
"2. MEALS":PRINTTAB(5)"3. ENTERTAINMENT"
440 PRINTTAB(5)"4. TRAVEL":PRINTTAB(5)"5
. MISCELLANEOUS":RETURN
450 IFEOF(1)THENCLOSE:RETURN
460 INPUT#1,Z,N,C,Y,X
470 B=B+C:IFL=ZTHENA=A+C:IFH="Y"THENLPRI
NTTAB(3)N;TAB(18);:LPRINTUSINGG;C;:LPRIN
TTAB(30)Y;TAB(50);X
480 IFP=NTHENF=F+C:A=F:IFH="Y"THENLPRINT
TAB(5)N;TAB(25);:LPRINTUSINGG;C;:LPRINTT
AB(40)Y;TAB(55);X
490 GOTO450
```

each category or provides a grand total of all expenses.

The miscellaneous option lets you print a total of all miscellaneous expenses or a total of any recurring expenses in the miscellaneous file (like tolls). You can obtain a printout of every total. The grand total printout prints only the grand total amount. If you want a printout of individual expenses, print each category's total. ■

Punch Out

Conversion by Mare-Anne Jarvela
***80 Micro* Technical Editor**

This payroll program, Listing 4, tallies timecards and calculates certain payroll deductions. It is a conversion of James J. Conroy's program (*80 Microcomputing*, February 1981, p. 198).

The program has a looping routine based on how many time-in/time-out entries the operator decides to make. The screen first displays "How many periods are there?" After the appropriate number is entered, the computer asks for the time in (including a.m. or p.m.) and the time out. Carefully enter each time without any punctuation. You must also hit enter after each entry.

When done correctly, the computer displays the time worked in hours and minutes and in total minutes. After the last time period is entered, the computer pauses and a list of all the payroll entries appears in total minutes. The total hours and minutes worked are then displayed.

Then the hourly pay rate is entered and the gross pay appears on the screen.

The withholding deductions are calculated and the final deductions and net pay appear on the screen. FICA, federal withholding, and state and local taxes are calculated.

Q	Number of time periods	G	Pay rate
T	Total	GP	Gross pay
T1	Time punched in	F	Federal deduction
T2	Time punched out	Soc	Social Security
Z1	a.m. or p.m. (punch in)	ST	State tax
Z2	a.m. or p.m. (punch out)	CT	Local tax
TMIN	Total minutes left	A$	INKEY (Y/N)
HTT	Hours until twelve	X	Loop counter
HFT	Hours from twelve to time out	Y	Loop counter
THRS	Total hours	D	Counter

Table 4. Punch Out Variables

```
4 REM PUNCH-TIME CLOCK PROGRAM FOR THE M
ODEL-100
10 CLS:CLEAR
25 INPUT "HOW MANY TIME PERIODS ARE THER
E";Q
27 DIM L(Q)
30 T=0
35 FOR D=0 TO Q:IF D=Q THEN GOTO330
40 PRINT:INPUT "TYPE THE TIME PUNCHED IN
";T1
45 INPUT"ENTER AM OR PM (A/P)";Z1$
50 INPUT"TYPE THE TIME PUNCHED OUT";T2
55 INPUT"ENTER AM OR PM (A/P)";Z2$
60 CLS
70 FOR X=100 TO 1200 STEP 100
75 IF T1-X < 60 THEN GOTO 90
80 NEXT X
90 FOR Y=100 TO 1200 STEP 100
95 IF T2-Y<60 THEN GOTO 110
100 NEXT Y
110 IF Z1$=Z2$ THEN GOTO 125
115 IF Z1$<>Z2$ THEN GOTO 215
125 IF T1-X>0 THEN 160 ELSE 135
135 HRS=Y*.01-X*.01:IF X*.01=12 THEN HRS
=HRS+12
140 PRINT"TOTAL TIME WAS";HRS;"HOURS AND
";T2-Y,"MINUTES"
145 PRINT"OR:";HRS*60+(T2-Y);"TOTAL MINU
TES"
150 L(D)=HRS*60+(T2-Y):NEXT D
160 HRS=Y*.01-X*.01-1:IF X*.01=12 THEN H
RS=HRS+12
165 MIN=60-(T1-X)
180 TMIN=MIN+(T2-Y)
190 IF TMIN=>60 THEN TMIN=TMIN-60:HRS=HR
S+1
195 PRINT "TOTAL TIME WAS:";HRS;"HOURS A
ND";TMIN;"MINUTES"
200 PRINT"OR:";HRS*60+TMIN;"TOTAL MINUTE
S"
205 L(D)=HRS*60+TMIN: NEXT D
215 IF T1-X>0 THEN 275 ELSE 230
230 HTT=12-X*.01
245 HFT=Y*.01: IF Y*.01=12 THEN HFT=HFT-
12
250 THRS=HTT+HFT
255 PRINT"TOTAL TIME WAS:";THRS;"HOURS A
ND";T2-Y;"MINUTES"
260 PRINT"OR:";THRS*60+(T2-Y);"TOTAL MIN
UTES"
265 L(D)=THRS*60+(T2-Y):NEXT D
275 HTT=12-X*.01-(1)
280 MIN=60-(T1-X)
290 TMIN=(T2-Y)+MIN
295 HFT=Y*.01:IF Y*.01=12 THEN HFT=HFT-1
2
300 IF TMIN=>60 THEN TMIN=TMIN-60:HFT=HF
T+1
310 THRS=HTT+HFT
315 PRINT"TOTAL TIME WAS";THRS;"HOURS AN
D";TMIN;"MINUTES"
320 PRINT"OR:";THRS*60+(TMIN);"TOTAL MIN
UTES"
325 L(D)=THRS*60+(TMIN): NEXT D
330 FOR R=1 TO 2000:NEXT:CLS:PRINT"CALCU
LATING TOTAL TIME FOR PAY"
335 FOR C=0 TO D-1
340 PRINT L(C):NEXT C
345 FOR C=0 TO D-1
350 T=T+L(C):NEXT C
355 PRINT T;" (TOTAL MINUTES)"
360 PRINT"TOTAL TIME WAS";T/60;"HOURS"
362 PRINT:PRINT: PRINT "PRESS ENTER TO C
ONTINUE";:INPUTY$
365 CLS:INPUT"WHAT IS YOUR RATE OF PAY";
G
370 GP=INT((G*(T/60))*100+.5)/100
375 PRINT"GROSS PAY IS:";:PRINT USING"$$
###.##";GP
380 INPUT"ENTER THE FED. DEDUCTION";F
382 PRINT:PRINT: PRINT"PRESS ENTER TO CO
NTINUE";:INPUTY$
385 CLS:PRINT"****** DEDUCTIONS ARE:"
390 SOC=INT((GP*.0665)*100+.5)/100:PRINT
"1.  FICA (SOC. SEC.) IS:";SOC
395 PRINT"2.  FED. WITHHOLDING IS:";F
400 ST=INT((GP*.022)*100+.5)/100:PRINT"3
.  STATE TAX IS:"ST
405 CT=INT((GP*.01)*100+.5)/100:PRINT"4.
  LOCAL TAX IS:"CT
410 PRINT"TOTAL DEDUCTIONS ARE";SOC+ST+F
+CT
415 PRINT"****** NET PAY IS:";GP-SOC-F-S
T-CT
420 INPUT"DO YOU WANT TO RUN ANOTHER PAY
? (Y/N)";A$
425 IF A$="Y" THEN CLS:CLEAR:GOTO25
430 END
```

Program Listing 4. Punch Out

You can change these deductions in the program to suit your individual needs. For users who don't want to look up the federal withholding deduction from a schedule, use the classical percentage method to figure the correct deduction.

The program has four subroutines that encompass all possible combinations of time-in/time-out entries for figuring elapsed work time. The total work time is accurate, since it is figured from the total minutes worked.

If you want a written record, change the Print statements in the program to LPRINT. If you want to calculate overtime pay you can put provisions in to detect and account for it. ■

Itinerary 100

Conversion by Brad Dixon
***80 Micro* Technical Editor**

In today's mobile society, applications for portable computers have come to the forefront. This menu-driven itinerary program (Listing 5) is a conversion of a program by Ben Gorsky (*80 Microcomputing*, April 1980, p. 95). It requires at least 10K of usable RAM, including memory space for data files.

Two files store travel information: the first keeps track of flights, hotels, car rentals, and other reservations; the second stores payment records. These files are stored in RAM as listed in the program, but could be stored on tape by changing the RAM file statement to a tape file statement. The list of variables used in the program appears in Table 5.

Program housekeeping is done in line 10, with the title page and main menu following in lines 20–100. Option 1 in the main menu loads the data recorded during earlier sessions in RAM. Options 2–6 begin by checking the file data for previous entries. If none are found, you are notified and given the option to add file information. If data is found, it is displayed. You can then add or delete file records, or leave the file as it is and return to the main menu.

Option 7 directs the program to the printer routine, giving a hard copy of all

the data in your itinerary in the same order as in the main menu. After all data for your travel itinerary has been entered, Option 8 loads it into RAM files for retrieval as needed.

Special Instructions and Modifications

When entering hotel addresses under Option 3, you must put slashes (/) between the lines in the address. These signal the printer to start a new line under Option 7. Under the flights option (2), enter the time in four numbers without a colon between the hours and minutes. Enter dates for Options 2, 3, 5, and 6 in the conventional format (MM/DD/YY or MM-DD-YY).

Each session ends when the input information is stored in RAM files. If you press the break key at any time before using Option 8, all your itinerary data for that session will be erased.

Modifications to Itinerary 100 are limited only by your specific needs and the amount of memory available in your Model 100. However, one useful modification is to randomly access the files to list all data pertaining to a particular date or location in your travels. ■

NFT	Number of flights
FDATE(I)	Date of 1st flight
ALN(I)	Airline
DPCIT(I)	Departure city
DEPTM(I)	Departure time
NM(I)	Flight number
ACIT(I)	Arrival city
ATM(I)	Arrival time
NHOT	Number of hotels
ADAT(I)	Arrival date at 1st hotel
HOTNAM(I)	Name
DR(I)	Address
DDAT(I)	Departure date
NO	Number of other reservations
OT(I)	Data for other reservations
NACT	Number of accounting items
WHO(I)	Name of party to pay for 1st item
DATDUE(I)	Date payment due
STSNT(I)	Date payment sent
DOLDEP(I)	Amount of payment
NCAR	Number of rental cars
RSNM(I)	Reservation number for 1st reservation
AGNCY(I)	Rental agency
PDAT(I)	Pick-up date
PLC(I)	Pick-up location
RDAT(I)	Return date
RLC(I)	Return location
TRPNM	Trip name or title

Table 5. Itinerary 100 Variables

Program Listing 5. Itinerary 100

```
10 CLEAR500:DEFINT I,N,K:DEFSTR
F,A,D,Z,H,O,P,W,R,T
20
CLS:PRINT@135,"ITINERARY":PRINT@171,"FOR
THE MODEL 100"
22 FOR Y=1 TO 1000: NEXT Y
100 CLS:PRINT"  YOU MAY SELECT ANY OF
THESE FUNCTIONS":PRINTTAB(8)"1-INPUT
RESERVATION DATA":PRINTTAB(6)"2-FLIGHT
DATA":PRINT@101,"3-HOTEL DATA":PRINTTAB(
2)"4-OTHER RESERVATIONS":PRINT@144,"5-
CAR RENTALS"
110 PRINTTAB(8)"6-DEPOSITS AND
PAYMENTS":PRINTTAB(3)"7-PRINT
ITINERARY":PRINT@222,"8-RECORD DATA"
120 PRINT:INPUT"YOUR CHOICE";K:ON K GOTO
150,200,410,610,810,1000,1200,1510
150 'INPUT DATA FROM FILE
160 CLS:INPUT"HIT ENTER TO LOAD DATA
FILE";Z:OPEN"RAM:ITINER.DO"FORINPUT AS
1:INPUT#1,NFT,NHOT,NO,NACT,NCAR:FORI=1TO
NFT:INPUT#1,FDATE(I),ALN(I),DPCIT(I)
,DEPTM(I),NM(I),ACIT(I),ATM(I):NEXT
170 FOR I=1TONHOT:IFEOF(1)
THEN171:INPUT#1,ADAT(I),HOTNAM(I),DR(I)
,DDAT(I):NEXT
171 FOR I=1TONO:IFEOF(1)
THEN172:INPUT#1,OT(I):NEXT
172 FOR I=1TONACT:IFEOF(1)
THEN180:INPUT#1,WHO(I),DATDUE(I),DTSNT(I
),DOLDEP(I):NEXT
180 FOR I=1TONCAR:IFEOF(1)
THEN190:INPUT#1,RSNM(I),AGNCY(I),PDAT(I)
,PLC(I),RDAT(I),RETLC(I):NEXT:CLOSE:GOTO
100
190 CLOSE:GOTO100
200 CLS:PRINT:IF NFT=0 THEN PRINT@49,"NO
FLIGHTS LISTED":PRINT:GOTO 230
220
FORI=1TONFT:CLS:PRINT@56,"FLIGHTS":PRINT
@80,"#":PRINT@106,"DATE:":PRINT@120,"FLT
.#":PRINT@126,"AIRLNE":PRINT@136,"DEPART
":PRINT@150,"ARRIVE"
225 PRINT@82,I:PRINT@112,FDATE(I)
:PRINT@160,NM(I):PRINT@166,ALN(I)
:PRINT@173,DPCIT(I):PRINT@182,DEPTM(I)
:PRINT@187,ACIT(I):PRINT@196,ATM(I)
226 PRINT:INPUT"ENTER <C>ONTINUE OR <R>
ETURN";A$:IF
A$="R"THEN230ELSEIFA$="C"THENNEXTIELSE22
6
230 FOR
S=1TO1000:NEXTS:CLS:PRINT@96,"YOU
MAY":PRINT"<A>DD, <D>ELETE, OR <M>
AINTAIN LISTINGS.":PRINT:INPUT"YOUR
SELECTION";Z$:IFZ$="A"THEN 240 ELSE IF
Z$="D"THEN 320 ELSE IF Z$="M" THEN 100
ELSE 230
240 CLS:PRINTTAB(16)"FLIGHTS":PRINT"TO
ADD A FLIGHT BETWEEN 2
EXISTING":PRINT"FLIGHTS ENTER THE NUMBER
OF THE NEW":PRINT"FLIGHT IN
SEQUENCE.":PRINT"TO ADD A FLIGHT AT THE
END, ENTER THE":PRINT"NEXT NUMBER IN
THESEQUENCE.":PRINT:INPUT"FLIGHT
NUMBER";K
250 IF K>NFT THEN NFT=NFT+
1:K=NFT:GOTO270
260 NFT=NFT+1:FORI=NFT-1 TO K STEP -
1:FDATE(I+1)=FDATE(I):ALN(I+1)=ALN(I)
:DPCIT(I+1)=DPCIT(I):DEPTM(I+1)=DEPTM(I)
:NM(I+1)=NM(I):ACIT(I+1)=ACIT(I):ATM(I+1
)=ATM(I):FCOM(I+1)=FCOM(I):NEXT
```

Listing 5 continues

Listing 5 continued

```
270 INPUT "ENTER DATE OF FLIGHT";FDATE(K
)
275 INPUT"ENTER AIRLINE NAME";ALN(K)
280 INPUT"ENTER FLIGHT NUMBER";NM(K)
285 INPUT"ENTER DEPARTURE CITY";DPCIT(K)

290 INPUT"ENTER DEPARTURE TIME";DEPTM(K)

295 INPUT"ENTER ARRIVAL CITY";ACIT(K)
300 INPUT"ENTER ARRIVAL TIME";ATM(K)
310 GOTO 200
320 PRINT:PRINT:PRINT"ENTER THE
NUMBER":INPUT"OF THE FLIGHT TO BE
DELETED";J:NFT=NFT-1:FOR I=JTO NFT:FDATE
(I)=FDATE(I+1):ALN(I)=ALN(I+1):DPCIT(I)
=DPCIT(I+1):DEPTM(I)=DEPTM(I+1):NM(I)=NM
(I+1):ACIT(I)=ACIT(I+1)
330 ATM(I)=ATM(I+1):NEXT:GOTO200
410 CLS:IFNHOT=0THEN PRINT@52,"NO HOTELS
LISTED":GOTO430
420 FORI=1TONHOT:CLS:PRINTTAB(17)
"HOTELS":PRINT:PRINTI;"  ";HOTNAM(I)
,"ARRIVE ";ADAT(I):PRINT, "DEPART ";DDAT
(I)
425 PRINT:INPUT"ENTER <C>ONTINUE OR <R>
ETURN";A$:IF A$="C"THEN NEXTIELSE IF
A$="R"THEN 430 ELSE425
430 FOR S=1TO500:NEXTS:CLS:PRINT@86,"YOU
MAY <A>DD, <D>ELETE, OR":PRINT@127,"<M>
AINTAIN HOTEL LISTINGS":PRINT:INPUT"YOUR
SELECTION";Z$:IFZ$="A"THEN440ELSEIF
Z$="D"THEN550 ELSEIFZ$="M"THEN100
ELSE430
440 CLS:PRINT:PRINT"TO ADD A HOTEL
BETWEEN TWO IN THE LIST,":PRINT"ENTER
THE NEWHOTEL NUMBER."
445 PRINT"TO ADD A HOTEL TO THE
END,":PRINT"ENTER THE NEXT NUMBER IN
SEQUENCE.":PRINT:INPUT"HOTEL
NUMBER";K:IFK>NHOT THEN NHOT=NHOT+
1:GOTO460
450 NHOT=NHOT+1:FOR I=NHOT-1 TO KSTEP-
1:HOTNAM(I+1)=HOTNAM(I):ADAT(I+1)-ADAT(I
):DDAT(I+1)=DDAT(I):DR(I+1)=DR(I)
:NEXT460 INPUT"ENTER NAME OF
HOTEL";HOTNAM(K)
470 PRINT"ENTER ADDRESS OF HOTEL":INPUT"
(PUT '/' BETWEEN ADDRESS LINES";DR(K)
480 INPUT"ENTER ARRIVAL DATE";ADAT(K)
490 INPUT"ENTER DEPARTURE DATE";DDAT(K)
:GOTO410
550 INPUT"ENTER NUMBER OF HOTEL TO BE
DELETED";K
560 FOR I=KTONHOT:HOTNAM(I)=HOTNAM(I+1)
:DR(I)=DR(I+1):ADAT(I)=ADAT(I+1):DDAT(I)
=DDAT(I+1):NEXT:NHOT=NHOT-1:GOTO410
610 CLS:PRINT:IF NO=0 THENPRINT@86,"NO
OTHER RESERVATIONS LISTED":GOTO 630
620 CLS:FORI=1 TO NO:PRINT@45,I;"
";OTH(I):PRINT:PRINT:INPUT"ENTER <C>
ONTINUE OR <R>ETURN";A$:IF
A$="C"THENNEXTIELSEIFA$="R"THEN630
630 FOR S=1TO500:NEXTS:CLS:PRINT@88,"YOU
MAY <A>DD, <D>ELETE,":PRINT@124,"OR <M>
AINTAIN OTHER
RESERVATIONS":PRINT:PRINT:INPUT"YOUR
SELECTION";Z$:IFZ$="A"THEN640ELSEIFZ$="D
"THEN670 ELSEIFZ$="M"THEN100 ELSE 630
640 NO=NO+1:PRINT:INPUT"ENTER
RESERVATION INFORMATION";OTH(NO):GOTO610

670 PRINT:INPUT"ENTER RESERVATION TO BE
DELETED";K:NO=NO-1:FORI=KTONO:OTH(I)
=OTHD(I+1):NEXT:GOTO610
810 CLS:IFNCAR=0THEN PRINT:PRINT@89,"NO
CAR RENTALS LISTED":PRINT:GOTO830
820 FOR I=1TONCAR:CLS:PRINT@54,"CAR
RENTALS":PRINT@77,"#"I:PRINT@83,"AGENCY:
"AGNCY(I):PRINT@105,"REG.#: "RSNM(I)
:PRINT@165,"PICKUP:"PDAT(I)
:PRINT@185,PLC(I):PRINT@205,"RETURN:
"RDAT(I):PRINT@225,RETLC(I)
825 PRINT:INPUT"ENTER <C>ONTINUE OR <R>
ETURN";A$:IFA$="C"THEN NEXTIELSE
IFA$="R"THEN830ELSE825
830 FOR S=1TO500:NEXTS:CLS:PRINT@88,"YOU
MAY <A>DD, <D>ELETE,":PRINT@127,"OR <M>
AINTAIN CAR
RENTALS":PRINT:PRINT:INPUT"YOUR
SELECTION";Z$:IFZ$="A"THEN840ELSE
IFZ$="D"THEN950 ELSEIFZ$="M"THEN100 ELSE
830
840 CLS:PRINT"TO ADD A RENTAL BETWEEN
TWO ":PRINT"EXISTING ONES, ENTER THE
NUMBER ":PRINT"FOR THE NEW
RENTAL.":PRINT"TO ADD A NEW RENTAL TO
THE END ":PRINT"OF THE LIST, ENTER THE
NEXT ":PRINT"NUMBER IN THE
SEQUENCE.":PRINT
845 INPUT"RENTAL NUMBER";K
850 IFK>NCARTHEN NCAR=NCAR+
1:K=NCAR:GOTO870
860 NCAR=NCAR+1:FORI=NCAR TO KSTEP-
1:RSNM(I+1)=RSNM(I):AGNCY(I+1)=AGNCY(I)
:PDAT(I+1)=PDAT(I):PLC(I+1)=PLC(I):RDAT(
I+1)=RDAT(I):RETLC(I+1)=RETLC(I):NEXT
870 INPUT"ENTER AGENCY NAME";AGNCY(K)
880 INPUT"ENTER RESERVATION NUMBER";RSNM
(K)
890 INPUT"ENTER PICK UP DATE";PDAT(K)
900 INPUT"ENTER PICK UP LOCATION";PLC(K)

910 INPUT"ENTER RETURN DATE";RDAT(K)
920 INPUT"ENTER RETURN LOCATION";RETLC(K
):GOTO810
950 INPUT"ENTER RENTAL NUMBER TO BE
DELETED";J:NCAR=NCAR-
1:FORI=JTONCAR:RESNM(I)=RESNM(I+1):AGNCY
(I)=AGNCY(I+1):PDAT(I)=PDAT(I+1):PLC(I)
=PLC(I+1):RDAT(I)=RDAT(I+1):RETLC(I)
=RETLC(I+1):NEXT
960 GOTO810
1000 CLS:IFNACT=0THEN PRINT@48,"NO
PAYMENT ITEMS LISTED":GOTO1030
1020 FORI=1TONACT:
CLS:PRINT@56,"PAYMENTS":PRINT@83,"#"I:PR
INT@103,"AMOUNT: $"DOLDEP(I)
:PRINT@132,"TO: "WHO(I):PRINT@160,"DATE
DUE: "DATDUE(I):PRINT@180,"DATE SENT:
"DTSNT(I)
1025 PRINT:INPUT"ENTER <C>ONTINUE OR <R>
ETURN";S$:IFS$="C"THEN
NEXTIELSEIFS$="R"THEN1030ELSE1025
1030 FORS=1TO500:NEXTS:CLS:PRINT@88,"YOU
MAY <A>DD, <D>ELETE,":PRINT@129," OR <M>
AINTAIN PAYMENTS":PRINT:INPUT"YOUR
SELECTION";Z$:IFZ$="A"THEN1040
ELSEIFZ$="D"THEN1100 ELSEIFZ$="M"THEN100
ELSE1030
1040 NACT=NACT+1
1050 PRINT:PRINT"ENTER NAME OF AGENCY
REQUIRING PAYMENT":INPUTWHO(NACT)
1060 INPUT"ENTER AMOUNT DUE";DOLDEP(NACT
)
1070 INPUT"ENTER DATE DUE";DATDUE(NACT)
1080 INPUT"ENTER DATE SENT";DTSNT(NACT)
```

Listing 5 continues

Listing 5 continued

```
:GOTO1000
1100 INPUT"ENTER PAYMENT NUMBER TO BE
DELETED";J:NACT=NACT-1:FORI=JTONACT:WHO(
I)=WHO(I+1):DOLDEP(I)=DOLDEP(I+1):DATDUE
(I)=DATDUE(I+1):DTSNT(I)=DTSNT(I+1)
:GOTO1000
1200 CLS:PRINT@47,"ENTER TITLE FOR
ITINERARY":PRINT:INPUTTRPNM
1220 INPUT"HIT <ENTER> WHEN THE PRINTER
IS READY";Z:LPRINTSTRING$(4,"-")
1230 LPRINTSTRING$(69,"X")
:LPRINT:LPRINTTAB((72-LEN(TRPNM))/2)
TRPNM:LPRINT:LPRINTSTRING$(69,"X")
:LPRINT:LPRINT:LPRINT
1240 LPRINTTAB(25)"F L I G H T S":LPRINT

1250 FOR I=1TONFT:LPRINT FDATE(I);TAB(20
)ALN(I);TAB(26)"DEP ";DPCIT(I);TAB(50)
"AT ";DEPTM(I):LPRINTTAB(20)"#";NM(I)
;TAB(26)"ARV ";ACIT(I);TAB(50)"AT ";ATM(
I):LPRINT:NEXT
1270 LPRINT:LPRINT:LPRINTTAB(25)"H O T E
L S":LPRINT
1280 FORI=1TONHOT:LPRINT HOTNAM(I);TAB(
20)"ARV ";ADAT(I);TAB(40)"DEP ";DDAT(I)
:A=DR(I)
1290 FORJ=1TOLEN(A):IFMID$(A,J,1)<>"/
"THENNEXT:GOTO1310
1300 F=LEFT$(A,J-1):LPRINT F:A=RIGHT$(
A,LEN(A)-J):GOTO1290
1310 LPRINT A:LPRINT:NEXT:LPRINT:LPRINT
1320 LPRINTTAB(15)"C A R  R E N T A L
S":LPRINT
1330 FORI=1TONCAR:LPRINT AGNCY(I);TAB(15
)"PICK UP ";PDAT(I);" AT ";PLC(I)
:LPRINTRSNM(I);TAB(15)"RETURN ";RDAT(I)
;" AT ";RETLC(I)
:LPRINT:NEXT:LPRINT:LPRINT
1340 LPRINTTAB(25)"O T H E R":LPRINT
1350 FORI=1TONO:LPRINT OT(I):LPRINT:NEXT

1360 LPRINT:LPRINT:GOTO100
1510 CLS:PRINTTAB(20)"RECORDING DATA"
1520 OPEN"RAM:ITINER.DO"FOROUTPUTAS1
1525
PRINT#1,NFT",";NHOT",";NO",";NACT",";NCA
R:FORI=1TONFT:PRINT#1,FDAT(I)",";ALN(I)"
,";DPCIT(I)",";DEPTM(I)",";NM(I)",";ACIT
(I)",";ATM(I):NEXT
1530
FORI=1TONHOT:PRINT#1,ADAT(I)",";HOTNAM(I
)",";DR(I)",";DDAT(I):NEXT
1540 FORI=1TONO:PRINT#1,OT(I):NEXT
1550
FORI=1TONACT:PRINT#1,WHO(I)",";DATDUE(I)
",";DTSNT(I)",";DOLDEP(I):NEXT
1560
FORI=1TONCAR:PRINT#1,RSNM(I)",";AGNCY(I)
",";PDAT(I)",";PLC(I)",";RDAT(I)",";RETL
C(I):NEXT:CLOSE:GOTO100
```

The Final Notice

Conversion by Mare-Anne Jarvela
***80 Micro* Technical Editor**

This payment-scheduling program (Listing 6) is a conversion of one by Walter J. Atkins, which appeared in the February 1981 issue of *80 Microcomputing* (p. 200). It displays all accounts due on the 1st, the 15th, or between any other two dates of the month.

The account files are stored in data statements at the end of the program. The format is: Line# DATA"account name", "account #", due date, amount due. See lines 600–680 in the program listing.

After you choose a method of reporting, the program asks if the account numbers are to be displayed. N suppresses the numbers.

At the end of your display, you'll see the total number of accounts due and the total amount due. ■

D	Option variable
D1	Start date
D2	Stop date
A	Amount due
T	Total amount
C	Counter
H	Counter
F	Counter
A$	Account number
N$	Name
I$	INKEY

Table 6. The Final Notice Variables

Program Listing 6. The Final Notice

```
10 REM PAYMENT DUE DATE
20 REM FOR THE MODEL-100   APRIL 83
70 CLS:PRINTTAB(10)"PAYMENT DUE DATES"
80 PRINT"FUNCTIONS AVAILABLE ARE :"
90 PRINT"   1. ACCOUNTS DUE 1ST OF MONTH
100 PRINT"   2. ACCOUNTS DUE 15TH OF MON
TH
110 PRINT"   3. ACCOUNTS DUE BETWEEN ANY
 TWO DATES
120 PRINTTAB(10)"SELECT ONE OPTION ":INP
UT"==>"; D:CLS
130 IF D>3 OR D<1 THEN 70
140 PRINT:PRINT
150 PRINT"DO YOU WANT ACCOUNT NUMBERS DI
SPLAYED (Y OR N)";
160 INPUT I$:I$=LEFT$(I$,1)
170 IF I$<>"Y"AND I$<>"N"THEN CLS: GOTO1
40
180 CLS
190 ON D GOTO 200,240,280
200 GOSUB 450
210 IF D<17THEN GOSUB 480
220 IF F<>1 THEN 200
230 GOSUB 540:GOTO 60
240 GOSUB 450
250 IF D>=17 THEN GOSUB 480
260 IF F<>1 THEN 240
270 GOSUB 540:GOTO 60
280 PRINT:PRINT
290 INPUT"START DATE (MAX=31)";D1
300 IF D1>31 OR D1<1 THEN CLS:GOTO290
310 INPUT"STOP DATE (MAX=31)";D2
320 IF D2>31 OR D2<1 THEN CLS:GOTO 310
330 IF D2<D1 THEN CLS:GOTO290
340 CLS
350 GOSUB 450
360 IF D>=D1 AND D<=D2THEN GOSUB 480
370 IF F<>1 THEN 350
380 GOSUB 540:GOTO60
390 PRINTC;". ";N$;
400 PRINTTAB(18)"DUE DATE :";D;
410 PRINTTAB(45)"AMOUNT $";A
420 IF I$="Y"THEN PRINTTAB(6)"ACCOUNT NU
MBER : ";A$
430 PRINT
440 RETURN
450 READ N$,A$,D,A
460 IF N$="END"THEN PRINT"NUMBER ACCOUNT
S:";C,"TOTAL DUE $";T:F=1
470 RETURN
```

Listing 6 continues

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Monitor 100

Conversion by Amee Eisenberg
***80 Micro* Technical Editor**

You might be curious to find out what's inside the Model 100 and where it's stored. When Sergio Zigras had similar questions about the Color Computer, he wrote a monitor program in Basic (*80 Micro,* January 1983, p. 252). Here the monitor is modified for the Model 100 (see Listing 7).

The monitor offers five main menu options:

- M (Memory examine and modify)
- D (Dump a block of memory)
- F (Find a character or string of characters within a specified block of memory)
- C (Convert from hex to decimal or vice versa)
- E (End)

To conserve memory space, this program is unforgiving of input format errors. If you enter a command in lowercase characters or without its required parameters, a function call error results.

Memory Examine and Modify

The input format is MXXXX (enter).

This command displays the contents of a specified hexadecimal address (XXXX) and allows you to change it.

The output format is:

```
HEX ADDRESS = XXXX
BYTE = xx
ASCII CHARACTER = '(character)'
Next Action: H(igher), L(ower), R(estart),
(change to)XX?
```

The monitor responds to this command by showing the specified hexadecimal (hex) address (XXXX), the hex byte contained at that address (xx) and the ASCII character equivalent to

Program Listing 7. Monitor 100

```
5 CLEAR 500:CLS:PRINT@85,"WARNING:Bad Inpu
t Format Will Cause":PRINT@125,"Program To
 Fail":PRINT@205,"READ THE MANUAL!"
10 GOTO800
20 H$="":GOSUB60:HB$=H$:RETURN
30 V$=HB$:DA=0:GOSUB90:DB=DA:RETURN
40 ER=0:IFV<48ORV>70THENER=1ELSEIFV<58THEN
V=V-48ELSEIFV>63THENV=V-55
45 RETURN
50 H$="":A=DA/4096:A=INT(A):GOSUB64:DB=DA-
4096*A
56 A=DB/256:A=INT(A):GOSUB64:DB=DB-256*A
58 DB=DB-256*A
60 A=DB/16:A=INT(A):GOSUB64:A=DB-16*A
64 AA=A:IFA>9THENA=A+55ELSEA=A+48
66 A$=CHR$(A):H$=H$+A$:A=AA:RETURN
72 HB$=HA$
74 V=ASC(HB$):GOSUB40:IFER=1THEN110ELSEDA=
4096*V:V$=MID$(HB$,2,1):V=ASC(V$):GOSUB40:
IFER=1THEN110
76 DB=256*V:DA=DA+DB:V$=MID$(HB$,3,1)
90 V=ASC(V$):GOSUB40:IFER=1THEN110ELSEDB=1
6*V:DA=DA+DB:V$=RIGHT$(HB$,1):V=ASC(V$):GO
SUB40:IFER=1THEN110ELSEDA=DA+V:RETURN
110 PRINT"ERROR,NOT HEX":RETURN
120 PA$="":FORX=1TO4:DB=PEEK(DA):GOSUB20:P
A$=PA$+HB$:DA=DA+1:NEXT:RETURN
130 A$="":FORX=1TO8:DB=PEEK(DA):IFDB<32THE
NDB=46
135 P$=CHR$(DB):A$=A$+P$:DA=DA+1:NEXT:RETU
RN
200 CLS:HA$=MID$(O$,3,4):GOSUB72:IFER=1THE
N10
210 SDA=DA:DB=PEEK(DA):XDB=DB:IFDB<32THENX
DB=46ELSEB$=CHR$(XDB)
215 CLS:GOSUB20:PRINT@46,"HEX ADDRESS=";HA
$:PRINT@133,"BYTE=";HB$:PRINT@202,"ASCII C
HARACTER='";B$;"'"
220 INPUT" Next Action: H(igher),L(ower),R
(estart),(change to)XX";HB$
225 IFHB$="L"THEN275ELSEIFHB$="H"THEN260EL
SEIFHB$="R"THEN10
230 GOSUB30:IFER=1THEN255
240 POKE SDA,DB:CDB=PEEK(SDA):IFCDB<>DBTHE
NPRINT"NO CHANGE"
255 DA=SDA
260 DA=DA+1
265 GOSUB50:HA$=H$:GOTO210
275 DA=DA-1:GOTO265
300 BA$=MID$(O$,3,3):BA$=BA$+"0":EA$=MID$(
O$,8,4):HA$=EA$:GOSUB72:LA=DA:IFER=1THEN10
310 HA$=BA$:GOSUB72:IFER=1THEN10
320 IFMO=1THEN405ELSEGOSUB120:FI$=PA$:GOSU
B120:SE$=PA$:DA=DA-8:GOSUB130:PRINTBA$;"
";FI$;" ";SE$;" "A$
340 IFDA>=LATHEN10
345 GOSUB50:BA$=H$:GOTO320
400 PRINT MO=1:GOTO300
405 BE=DA:MO=0:IN$=MID$(O$,13):CNT=LEN(IN$
)/2:CNT=INT(CNT)
415 BL$="":FORZ=1TOCNT:DB=PEEK(DA):GOSUB20
:BL$=BL$+H$:DA=DA+1:NEXT:IFBL$=IN$THEN450
440 BE=BE+1:DA=BE:IFBE=LATHEN10ELSEGOTO415
450 DA=BE:GOSUB50:PRINTIN$;" is at ";H$" "
;:DA=DA+CNT:GOTO440
500 CO$=MID$(O$,3,1):IFCO$="D"THEN530ELSEH
$=MID$(O$,5):DA=VAL(H$):IFDA>65535THENPRIN
T"BEYOND RANGE":GOTO10
505 GOSUB50:PRINT@85,DA;"Dec.="H$;"Hex":GO
TO10
530 HB$=MID$(O$,5):L=LEN(HB$):IFL<>4THENPR
INT"4 HEX CHARS ONLY":GOTO10
535 GOSUB74:PRINT@85,HB$" Hex=";DA;"decima
l":GOTO10
800 PRINT:PRINT"MONITOR COMMANDS:M,D,F,C,E
":INPUTO$:C$=LEFT$(O$,1)
810 CLS:IFC$="M"THEN200ELSEIFC$="D"THEN300
ELSEIFC$="F"THEN400ELSEIFC$="C"THEN500ELSE
IFC$="E"THENEND
820 PRINT"WHAT?":GOTO10
```

Listing 6 continued

```
480 IF N$="END"THEN 530
490 C=C+1
500 T=T+A
510 IF H=0THEN GOSUB 580:H=1
520 GOSUB 390
530 RETURN
540 PRINT:INPUT"CONTINUE (Y OR N) ";I$:I
$=LEFT$(I$,1)
550 IF I$<>"Y" AND I$<>"N"THEN 540
560 IF I$="N"THEN CLS:END
570 RETURN
580 PRINTTAB(15)" A C C O U N T S   D U
E ":PRINT
590 RETURN
600 DATA"DOE&CO","A1234-RT",2,12.50
610 DATA"JONES","22233",5,1432.56
620 DATA"SMITH","3344E",22,65.89
630 DATA"TOM","SA22234",25,34.87
640 DATA"UNIVERSAL INDUSTRIES","123HH4",
30,56.54
650 DATA"HARRY","QW223-A",3,34.34
660 DATA"DICK","ABC 123",14,75.75
670 DATA"JANE","23-456",26,67.89
680 DATA"END","",0,0
690 END
```

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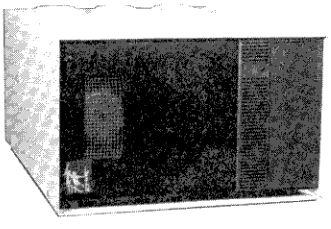

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that byte.

The program now offers four possible actions: H(igher), L(ower), R(estart) and (change to)XX.

H displays the next higher address (XXXX + 1) with its contents and ASCII character.

L displays the next lower address (XXXX − 1) with its contents and ASCII character.

R restarts the program by returning to the main menu.

XX changes the contents of the current memory location, then displays the next higher memory address with its contents. If you attempt a change to a read-only memory (ROM) location, the screen flashes "No Change" and displays the next higher memory location.

Dump a Memory Block

The input format is D XXXX YYYY (enter).

The Dump command reveals the contents of a block of memory beginning at hex address XXXX and ending with hex address YYYY.

The output format is "xxxx→→ HEXBYTES HEXBYTES" (ASCII characters).

The output from the Dump command consists of the hex address of the first byte on the display line (xxxx), the hex characters for the 8 bytes (HEXBYTES HEXBYTES), and their ASCII equivalents. Remember, two hex characters equal 1 byte. This means 8 bytes of information are represented by 16 characters.

If the memory block being dumped is greater than eight lines, use the pause key to slow the display.

When the dump is complete, the program returns to the main menu.

Find a Character

The input format is F XXXX YYYY z . . . z (enter).

Find seeks every occurrence of the specified hex character or group of characters (z . . . z) within a selected block of memory (from XXXX to YYYY).

This command is slow. One way to make it seem faster is to search through short blocks of memory. While the program is searching, the screen goes blank.

The output format is "z . . . z is at xx."

When found, the starting hex address (xx) of the string (z . . . z) is printed on the screen. The program then returns to the main menu. If the specified character or string is not located within the block of memory, the program just returns to the main menu.

Convert to Hex or Decimal

The input format to Convert to Hex is C H DD (enter). The format to Convert to Decimal is C D XXXX (enter).

Convert to Hex changes a two-character decimal input (DD) into its equivalent hex notation. Using longer decimal numbers can yield incorrect results or function call errors.

Convert to Decimal changes a four-character hex number (XXXX) to the equivalent decimal number. This command requires a four-character input. If the number to be converted has less than four characters, use leading zeros to fill the extra spaces.

The output format to Convert to Hex is "dd Dec. = xxxxHex." The output to Convert to Decimal is "xxxx HEX = dd decimal." The program returns to the main menu after doing the conversion.

End

The input format is E (enter).

The End command stops the program and returns to Basic. ■

Line	Description
20	Converts a decimal character to hex
30	Converts a hex character to decimal
40–45	Decimal nibble (4 bits, 1 digit) to hex
50–60	Decimal address to hex
64–66	Pack a hex address (four characters)
72–110	Hex address to decimal
120	Packs 4 hex bytes
130–135	Pack eight ASCII or graphics characters
200–275	M command
300–345	D command
400–450	F command
500–535	C command
800–820	Main routine, command decoding

Table 7. Monitor 100 Line Descriptions

The Rule of 78

Conversion by Beve Woodbury
***80 Micro* Technical Editor**

Two ways to calculate interest on a loan are: add-on interest, and annual percentage rate (APR).

Assume you are interested in an add-on interest rate of 12 percent for a two-year loan of $8,000 with monthly payments. The following equation calculates your monthly payments:

$$\text{Monthly payment} = \frac{\text{Interest*Years*Loan} + \text{Loan}}{12*\text{Years}}$$

The calculations for the loan specified above are:

$$\text{Monthly payment} = \frac{.12*2*8000 + 8000}{12*2}$$

$$\text{Monthly payment} = 413.33$$

Let's compute the value of the annual percentage rate that yields a payment of $413.33 per month for 24 months on a loan of $8,000. If payments are monthly, the interest per period is the APR divided by 12.

Under the standard amortization approach, the borrower pays interest for a period (a month) on the amount actually loaned during the period. The difference between the payment and the interest due reduces the remaining balance of the loan.

A number of approximation equations have been developed for the purpose of determining the APR associated with some add-on interest situations. No equation gives an exact answer except the one given below. The problem with this equation is that you must solve it by trial and error. There is no way to solve it directly.

$$\text{Monthly payment} = PV\ \frac{(i(1+i)\uparrow n)}{((1+i)\uparrow(n-1))}$$

The computer lends itself to solving the equation by trial and error.

After the APR is determined, it is possible to calculate a standard amortization table.

The Rule of 78 is an alternative method to determine the sum of money needed to pay off a loan. The Rule of 78 assumes (N/sum of the digits times the interest expense) is reduced the first period, ((N − 1)/sum of the digits times the

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interest expense) is reduced the second period, and so on, where N is the number of periods over which the loan runs.

Listing 8 compares the results of the two approaches. It's a conversion of "The Rule of 300," *80 Micro*, January 1982, p. 116. In general, the amount needed to pay off a loan using the Rule of 78 is greater than that using the normal amortization approach. This is illustrated in the sample run (see Figs. 1 and 2).

Running the Program

The example in the figures specified a loan of $8,000 for two years, with add-on interest (ADD) at a rate of 12 percent. The monthly payment is $413.33.

If you request hard copy, the following appears:

Loan: 8000
Add On Interest: 12 percent
Payment: 413.33
Annual Percentage Rate:
21.59999907016754 percent

The APR decimal is carried out this far because a small difference in the APR produces big variations in the results. If you rerun the program selecting to input the APR, enter 21.60 and you will get a monthly payment of $413.35.

Options are now given for the Rule of 78 or the regular amortization chart.

The key in this analysis is the difference in the amount needed to pay off a loan under the alternative approaches. In this example, the maximum difference occurs in the eighth month. Under the Rule of 78, $5,742.96 is needed to eliminate the loan. Only $5,704.62 is needed with the amortization approach.

From the finance company's point of view the rate of return earned on their money is greater if the loan is paid off early. The Rule of 78 is an alternative method of calculating the dollars necessary to pay off a loan. This approach is sometimes used for auto loans—be aware of the loan agreement details so you don't end up paying for your ignorance. ■

A$-K$	Word formats for printing
X$	Number format for printing
K-I	Loop counters
Decisions:	
L$	? ADD or APR
Y$	? hard copy
Z$	? which chart
Rule of 78 chart:	
IT	Interest
RXD	Principal reduction
RB	Balance of loan
DD	Difference
Amortization chart:	
IX	Interest
RD	Principal reduction
LX	Balance of loan
DD	Difference
Calculations:	
AD	Add-on interest rate
AP#	Annual percentage rate
LO	Loan amount
M	Number of months of loan
PAY	Monthly payment
S	Divisor in interest calculation
XP	Monthly payment calculated
YR	Number of years of loan

Table 8. The Rule of 78 Variables

```
LOAN:  8000
ADD ON INTEREST:  12 %
PAYMENT:  413.33
ANNUAL PERCENTAGE RATE 21.59999907016754
REGULAR AMORTIZATION

MONTH   INT.    REDUC    BALANCE    DIFF
  1   144.00   269.33   7730.67    -9.60
  2   139.15   274.18   7456.49   -17.65
  3   134.22   279.11   7177.38   -24.23
  4   129.19   284.14   6893.24   -29.44
  5   124.08   289.25   6603.99   -33.36
  6   118.87   294.46   6309.53   -36.09
  7   113.57   299.76   6009.77   -37.72
  8   108.18   305.15   5704.62   -38.34
  9   102.68   310.65   5393.97   -38.06
 10    97.09   316.24   5077.73   -36.97
 11    91.40   321.93   4755.80   -35.17
 12    85.60   327.73   4428.08   -32.76
 13    79.71   333.62   4094.45   -29.86
 14    73.70   339.63   3754.82   -26.56
 15    67.59   345.74   3409.08   -22.97
 16    61.36   351.97   3057.11   -19.21
 17    55.03   358.30   2698.81   -15.38
 18    48.58   364.75   2334.06   -11.60
 19    42.01   371.32   1962.74    -7.99
 20    35.33   378.00   1584.74    -4.66
 21    28.53   384.80   1199.94    -1.73
 22    21.60   391.73    808.21     0.67
 23    14.55   398.78    409.43     2.41
 24     7.37   409.43      0.00     0.00
```

Fig. 1. Regular Amortization

```
LOAN:  8000
ADD ON INTEREST:  12 %
PAYMENT:  413.33
ANNUAL PERCENTAGE RATE 21.59999907016754
RULE 78

MONTH   INT.    REDUC    BALANCE    DIFF
  1   153.60   259.73   7740.27    -9.60
  2   147.20   266.13   7474.14   -17.65
  3   140.80   272.53   7201.61   -24.23
  4   134.40   278.93   6922.68   -29.44
  5   128.00   285.33   6637.35   -33.36
  6   121.60   291.73   6345.62   -36.09
  7   115.20   298.13   6047.49   -37.72
  8   108.80   304.53   5742.96   -38.34
  9   102.40   310.93   5432.03   -38.06
 10    96.00   317.33   5114.70   -36.97
 11    89.60   323.73   4790.97   -35.17
 12    83.20   330.13   4460.84   -32.76
 13    76.80   336.53   4124.31   -29.86
 14    70.40   342.93   3781.38   -26.56
 15    64.00   349.33   3432.05   -22.97
 16    57.60   355.73   3076.32   -19.21
 17    51.20   362.13   2714.19   -15.38
 18    44.80   368.53   2345.66   -11.60
 19    38.40   374.93   1970.73    -7.99
 20    32.00   381.33   1589.40    -4.66
 21    25.60   387.73   1201.67    -1.73
 22    19.20   394.13    807.54     0.67
 23    12.80   400.53    407.01     2.41
 24     6.40   406.93      0.08     0.00
```

Fig. 2. Rule of 78

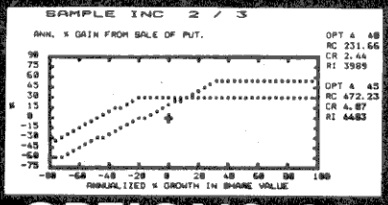
Program Listing 8. The Rule of 78

```
10 X$="###   ###.##   ####.##   #####.##   #
###.##"
20 A$="LOAN: ":B$="ADD ON INTEREST: ":C$
="PAYMENT: ":D$="ANNUAL PERCENTAGE RATE"
:E$="RULE 78":F$="REGULAR AMORTIZATION"
30 G$="MONTH ":H$=" INT.  ":I$=" REDUC
  BALANCE ":J$="   DIFF": K$="PAYMENT: "
40 CLS:PRINT:PRINTTAB(15)E$:PRINT@136,"V
ERSUS":PRINT@210,"AMORTIZATION TABLES":F
ORK=0 TO1000:NEXT:GOTO 90
50 X=(AP#*(1+AP#)^(YR*12)):PAY=LO*X/((1+
AP#)^(12*YR)-1):RETURN
60 X=INT(100*PAY)/100:Y=PAY-X:IFY>.005TH
ENX=X+.01
70 PAY=X:RETURN
80 CLS:PRINT"MONTHLY PAYMENT IS:";PAY:PR
INT:RETURN
```

Listing 8 continues

Listing 8 continued

```
90 PRINT:INPUT"LOAN";LO:INPUT"NUMBER OF
YEARS: ";YR
100 PRINT:PRINT"MENU":PRINT"    ADD      "
B$
110 PRINT"    APR     ";D$
120 INPUTL$:IFL$="APR"THEN 180
130 IFL$<>"ADD"THEN 100
140 INPUT"ADD ON INTEREST RATE: ";AD:AD=
AD*.01
150 PAY=(YR*AD*LO+LO)/(12*YR):GOSUB60:GO
SUB80:XP=PAY
160 FORI=1TO999:AP#=.0001*I+AD/12:GOSUB5
0:GOSUB60:IFPAY>=XPTHEN210
170 NEXTI:PRINT"ERROR":END
180 INPUT"% RATE";AP#:AP#=AP#*.01/12
190 GOSUB50:GOSUB60:XP=PAY
200 ADD=(12*YR*PAY-LO)/(LO*YR)
210 INPUT"HARD COPY Y/N: ";Y$:CLS:PRINTA
$;LO:PRINTB$;100*ADD;"%":IFY$="Y"THEN LP
RINTA$;LO:LPRINTB$;100*ADD;"%"
220 PRINTK$;XP:PRINTD$;1200*AP#;"%":IFY$
="Y"THENLPRINTK$;XP:LPRINTD$;1200*AP#:LP
RINT:LPRINT:LPRINT
230 PRINT:PRINT"ENTER Z FOR RULE 78 CHAR
T":INPUT"     A FOR REGULAR AMORTIZATION
";Z$:PRINT
240 IFZ$="A"THEN270ELSEIFZ$<>"Z"THEN230
250 PRINTTAB(10)E$:GOSUB350:IFY$="Y"THEN
LPRINTTAB(10)E$ELSEGOTO280
260 GOTO360
270 PRINTTAB(8)F$:GOSUB350:IFY$="Y"THENL
PRINTF$:GOTO360
280 S=0:M=12*YR:FORI=1TOM:S=S+I:NEXTI:RB
=LO:LX=LO
290 FORI=1TOM:IT=(M-I+1)/S*(YR*AD*LO):RX
D=XP-IT:RB=RB-RXD:IFI=MTHENIX=AP#*LX:RD=
LX:LX=0:DD=0:GOTO310
300 IX=AP#*LX:RD=XP-IX:LX=LX-RD:DD=LX-RB
310 IFZ$="A"THENPRINTUSINGX$;I,IX,RD,LX,
DD:IFY$="Y"THENLPRINTUSINGX$;I,IX,RD,LX,
DDELSEGOTO340
320 IFZ$="A"THEN340
330 PRINTUSINGX$;I,IT,RXD,RB,DD:IFY$="Y"
THENLPRINTUSINGX$;I,IT,RXD,RB,DD
340 NEXT:END
350 PRINT:PRINTG$;H$;I$;J$:RETURN
360 LPRINT:LPRINTG$;H$;I$;J$:GOTO280
```

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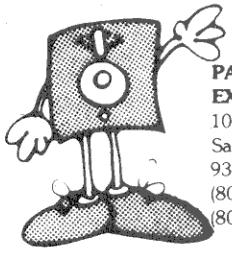

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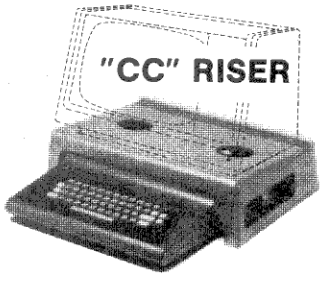

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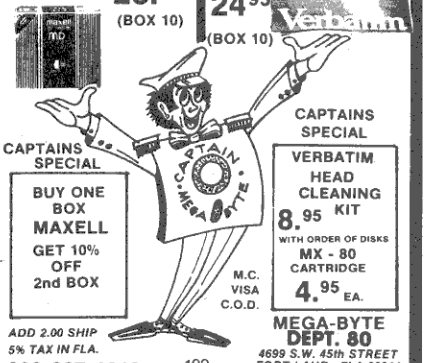

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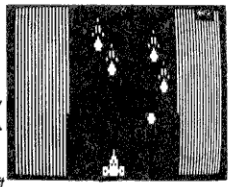

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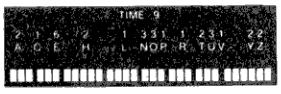

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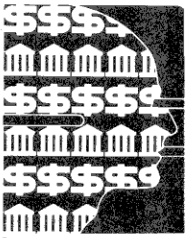

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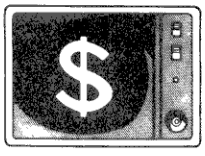

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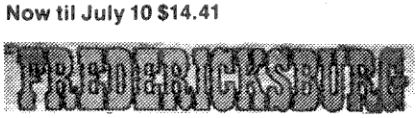

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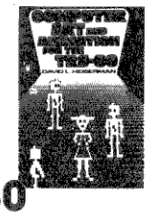

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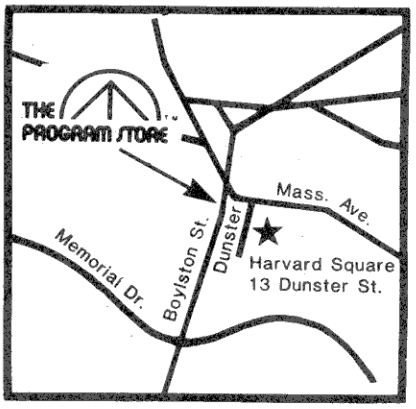

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Fortran Breakout

by J.B. Harrell

Remember the Pascal version of Breakout in our July 1981 issue? Here's the game again, demonstrating the power and speed of Fortran

Program Listing 1. USRLIB

```
00001           TITLE   *** USRLIB *** FORTRAN EXTENSIONS FOR TRS-80 ***
00002
00003
00004   ;       SUBROUTINE CLS - USE THE ROM ROUTINE AND CLEAR
00005   ;               THE VIDEO SCREEN.
00006   ;       EG.   CALL CLS
00007
00008           ENTRY   CLS
00009   CLS:    JP      01C9H           ;CLEAR THE SCREEN
00010
00011
00012   ;       INTEGER FUNCTION IRAND(MAX)  -  GENERATE A
00013   ;               RANDOM INTEGER VALUE IN THE RANGE OF
00014   ;               1 TO MAX USING THE ROM ROUTINES.  THIS
00015   ;               FUNCTION RETURNS AN INTEGER VALUE.
00016   ;       EG.  K=IRAND(50)
00017
00018           ENTRY IRAND
00019   IRAND:  LD      A,(HL)          ;GET "MAX" TO THE HL
00020           LD      E,A             ;REGISTER,  ADDR OF
00021           INC     HL              ;"MAX" IS IN HL ON
00022           LD      A,(HL)          ;ENTRY
00023           LD      D,A
00024           EX      DE,HL
00025           CALL    0A9AH           ;SET BASIC ACCUM, NTF
00026           CALL    14C9H           ;GENERATE RAND NUMBER
00027           JP      0A7FH           ;CINT(ACCUM) --> HL
00028
00029
00030   ;       SUBROUTINE RANDOM  --  RAMDOMIZE THE ROM
00031   ;               RANDOM NUMBER GENERATOR
00032   ;       EG.  CALL RANDOM
00033
00034           ENTRY   RANDOM
00035   RANDOM: JP      01D3H           ;CALL ROM "RANDOM"
00036
00037
00038   ;       LOGICAL FUNCTION GETCH(DUMMY) - SCAN KEYBOARD
00039   ;               AND RETURN A 8 BIT LOGICAL VALUE
00040   ;               CORRESPONDING TO THE KEY PRESSED.
00041   ;               GETCH WILL WAIT UNTIL A KEY HAS
00042   ;               BEEN PRESSED.
00043   ;       EG.  KEY=GETCH(0)
00044
00045           ENTRY   GETCH
00046   GETCH:  JP      0049H           ;CALL KEYBOARD SCAN
00047
00048
00049   ;       SUBROUTINE DISPL(CHAR)  -  DISPLAY THE 8 BIT
00050   ;               BYTE AT THE ADDRESS CHAR AS A CHARACTER
00051   ;               TO THE VIDEO SCREEN.  ANY VALID TRS-80
00052   ;               CHARACTER MAY BE DISPLAYED.
00053   ;       EG.   CALL DISPL(191)
00054
00055           ENTRY   DISPL
00056   DISPL:  LD      A,(HL)          ;GET CHARACTER
00057           JP      0033H
```

Listing 1 continues

Radio Shack's Fortran compiler and Macro-80 assembler make up a powerful software development system. The TRS-80 version of Fortran is an excellent implementation of the ANSI (American National Standards Institute) 1966 standard.

The most significant restriction in this version is the lack of the data type COMPLEX and routines for complex numbers. The compiler generates a mixture of native code and subroutine calls to a run-time library support package. This scheme generates code that runs about as fast as code in Assembly language. A compiler that produces only native code on a microprocessor with limited arithmetic capability (yes, the Z80 falls into this category) generates huge object programs.

Fortran has "record directed" input and output. This means each Read and Write statement produces a new record to be read or written. This is the language's most serious defect on the TRS-80—it is impossible, for example, to position the cursor and write at a specific location without disturbing the rest of the screen.

Additionally, the system run-time routines needed to support Read and Write statements and to decode Format statements are prohibitively large. The

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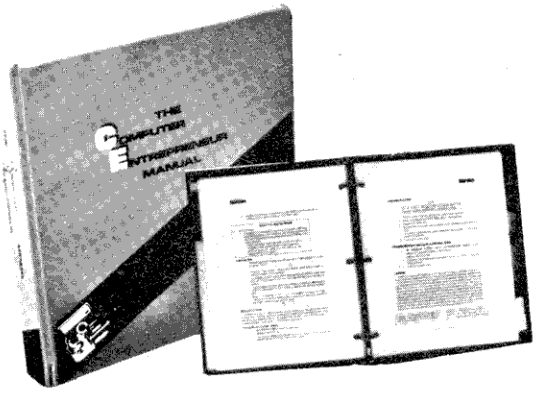

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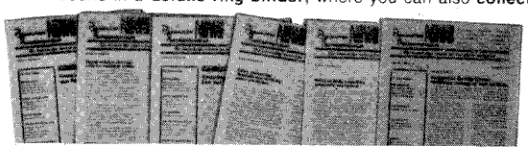

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Listing 1 continued

```
00058
00059
00060   ;       SUBROUTINE CRLF - SEND A CRLF (0DH) CODE TO THE
00061   ;               VIDEO SCREEN
00062   ;       EG.  CALL CRLF
00063
00064           ENTRY   CRLF
00065   CRLF:   LD      A,13            ;SET UP CALL TO DISPL
00066           JP      0033H           ;DISPLAY CRLF
00067
00068
00069   ;       SUBROUTINE OUTSTR(STRING)  -  OUTPUT THE CHAR
00070   ;               STRING AT THE PARAMETER ADDRESS TO THE
00071   ;               VIDEO SCREEN ONE CHARACTER AT A TIME.
00072   ;               "$" TERMINATES WITH NO CRLF.
00073   ;               "%" TERMINATES STRING WITH CRLF
00074   ;       EG.  CALL OUTSTR('THIS IS OUTPUT$')
00075   ;            CALL OUTSTR('OUTPUT WITH CRLF%')
00076
00077           ENTRY   OUTSTR
00078   OUTSTR: LD      A,(HL)          ;GET NEXT CHARACTER
00079           CP      '$'             ;TEST FOR TERMINATOR
00080           RET     Z               ;ALL DONE
00081           CP      '%'             ;TEST FOR CRLF
00082           JR      Z,CRLF          ;EXIT WITH CRLF
00083           CALL    0033H           ;DISPLAY CHARACTER
00084           INC     HL              ;BUMP POINTER
00085           JR      OUTSTR
00086
00087
00088   ;       SUBROUTINE PTC(LINE,ICOL)  -  SET THE SYSTEM
00089   ;               CURSOR (4020H) TO THE VIDEO SCREEN
00090   ;               ADDRESS CORRESPONDING TO LINE (0-15)
00091   ;               AND ICOL (0-63) BY:
00092   ;               ADDR <-- 3C00H + 64 * LINE + ICOL.
00093   ;               NO ERROR CHECKING ON LINE AND ICOL.
00094   ;       EG.   CALL PTC(10,45)
00095
00096           ENTRY   PTC
00097   PTC:    LD      A,(HL)          ;GET LINE NUMBER TO BC
00098           LD      C,A
00099           INC     HL
00100           LD      A,(HL)
00101           LD      B,A             ;LINE NUMBER IN BC REG
00102           LD      A,(DE)          ;GET COLUMN NUMBER
00103           LD      L,A             ;STORE IN HL
00104           INC     DE
00105           LD      A,(DE)
00106           LD      H,A             ;COLUMN NUMBER IN DE
00107           EX      DE,HL
00108           PUSH    BC
00109           POP     HL              ;LINE NUMBER IN HL
00110           ADD     HL,HL           ;2 * LINE
00111           ADD     HL,HL           ;4 * LINE
00112           ADD     HL,HL           ;8 * LINE
00113           ADD     HL,HL           ;16 * LINE
00114           ADD     HL,HL           ;32 * LINE
00115           ADD     HL,HL           ;64 * LINE
00116           ADD     HL,DE           ;64*LINE + ICOL
00117           LD      DE,3C00H
00118           ADD     HL,DE           ;VIDEO ADDR
00119           LD      (4020H),HL      ;SAVE IN CURSOR
00120           RET
00121
00122
00123   ;       SUBROUTINE OUTINT(NUMBER) - OUTPUT THE 16 BIT
00124   ;               INTEGER VALUE PASSED AS THE PARAMETER
00125   ;               "NUMBER" IN INTEGER FORMAT USING THE
00126   ;               BASIC ROM CONVERSION ROUTINES.  HAS
00127   ;               A LEADING BLANK.
00128   ;       EG.  CALL OUTINT(12345)
00129
00130           ENTRY   OUTINT
00131   OUTINT: LD      A,(HL)          ;GET NUMBER TO HL
00132           LD      E,A             ;REGISTER
00133           INC     HL
00134           LD      A,(HL)
00135           LD      D,A
00136           EX      DE,HL           ;NUMBER IN HL REG
00137           CALL    0A9AH           ;HL --> ACCUM. NTF
00138           CALL    0FBDH           ;CONVERT TO ASCII
00139   OUT2:   LD      A,(HL)          ;GET NEXT CHARACTER
00140           OR      A               ;STRING IS ENDED WITH 0
00141           RET     Z
00142           CALL    0033H           ;DISPLAY IT
00143           INC     HL
00144           JR      OUT2            ;FINISH STRING
00145
00146
00147   ;       INTEGER FUNCTION INNUM(LEN) - INPUT AN INTEGER
00148   ;               VALUE FROM THE KEYBOARD TO AN INTERNAL
00149   ;               BUFFER.  CONVERT THE NUMBER TO BINARY
00150   ;               AND RETURN THE INTEGER VALUE.  tHE
00151   ;               INTERNAL BUFFER IS SET AT A MAXIMUM OF
00152   ;               10 BYTES SO ENSURE THAT LEN <= 10.
00153   ;       EG.  NUMBER=INNUM(3)
00154
00155           ENTRY   INNUM
00156   INNUM:  LD      A,(HL)          ;GET LENGTH
00157           LD      B,A             ;SET UP CALL TO ROM
00158           LD      HL,INBUF        ;BUFFER ADDRESS
00159           CALL    05D9H           ;GO GET NUMBER
00160           EX      DE,HL           ;SAVE POINTER
00161           LD      HL,0            ;DEFAULT RETURN
00162           RET     C               ;<BREAK> KEY HIT
00163           LD      A,B             ;TEST FOR NO INPUT
00164           OR      A               ;REG B = INPUT LENGTH
00165           RET     Z
00166           LD      L,B             ;END STRING WITH 00H
00167           ADD     HL,DE
```

Listing 1 continues on p. 190

routines in USRLIB (Program Listing 1) let you create programs virtually free of Read, Write, and Format statements. The game Breakout (Program Listing 2) uses the routines in USRLIB. This program, when compiled with input/output statements only in subroutine INIT, requires about 9,600 bytes of storage. After replacing all I/O statements with calls to USRLIB, the compiled program needs only 4,100 bytes (see Program Listing 3). This is a space saving of over 50 percent!

USRLIB uses well-defined Model I ROM calls, and runs under most disk operating systems. You can even compile and link-edit a program on a Model I and transfer it to a Model III without modification.

USRLIB Explained

Each routine in USRLIB (Listing 1) includes an explanation of the routine and each calling parameter. An example of each calling sequence is followed by the actual subroutine.

"No results are expected from a subroutine call, but functions are required to return values to the calling program."

Fortran passes a parameter to a subroutine or function by passing the address pointer to the low byte of the parameter. Subprogram parameters always occupy 2 bytes (since they are passed as addresses) regardless of their type. Since USRLIB uses no more than three parameters for any routine, parameter pointers are passed by placing the addresses in 16-bit registers. Parameter address pointer 1 is passed in the HL register, parameter address pointer 2 is passed in the DE register, and parameter address pointer 3 is passed in the BC register. No results are expected from a subroutine call, but functions are required to return values to the calling program. USRLIB uses only logical and integer functions. Values are returned as an 8-bit value in the A register and a 16-bit value in the HL register.

Subroutine CLS (lines 4–9) performs a jump (JP) to the ROM routine at 01C9H to clear the video screen. I didn't use call because the calling program's return address is already on the stack. The RET instruction in the ROM

Continues on p. 191

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Listing 1 continued from p. 188

```
00168            LD      (HL),0
00169            EX      DE,HL           ;INPUT POINTER
00170            CALL    0E6CH           ;CONVERT TO BASIC ACCUM
00171            JP      0A7FH           ;CINT(ACCUM)-->HL REG
00172
00173            DSEG
00174   INBUF:   DS      11              ;STRING LENGTH + 0DH
00175            CSEG
00176
00177
00178   ;        <SETUP> IS A SUBROUTINE USED BY <PLOT> AND BY
00179   ;        <POINT> TO RETRIEVE THE PARAMETERS FROM THE
00180   ;        CALLING PROGRAM AND TO CALCULATE THE SCREEN
00181   ;        ADDRESS AND THE BIT POSITION OF THE GRAPHIC
00182   ;        BIT TO BE MANIPULATED.
00183   ;        ENTRY:  (HL) = X COORDINATE ADDRESS
00184   ;                (DE) = Y COORDINATE ADDRESS
00185   ;                (BC) = SET/RESET FLAG (NOT USED FOR
00186   ;                       <POINT> ROUTINE
00187   ;        EXIT:   (HL) = VIDEO SCREEN ADDRESS
00188   ;                (BC) = BIT NUMBER
00189   ;                (ZVAL) = SET/RESET FLAG
00190
00191   SETUP:   PUSH    HL              ;SET UP X COORD FETCH
00192            POP     IX
00193            LD      HL,XCOORD
00194            LD      A,(IX)
00195            LD      (HL),A          ;MOVE LOW BYTE
00196            INC     HL
00197            LD      A,(IX+1)
00198            LD      (HL),A          ;MOVE HIGH BYTE
00199            PUSH    DE              ;SET UP Y COORD FETCH
00200            POP     IX
00201            INC     HL
00202            LD      A,(IX)          ;MOVE LOW BYTE
00203            LD      (HL),A
00204            INC     HL
00205            LD      A,(IX+1)
00206            LD      (HL),A          ;MOVE HIGH BYTE
00207            PUSH    BC              ;SET UP ZVAL FETCH
00208            POP     IX
00209            INC     HL
00210            LD      A,(IX)          ;MOVE LOW BYTE
00211            LD      (HL),A
00212            INC     HL
00213            LD      A,(IX+1)
00214            LD      (HL),A
00215            LD      HL,(XCOORD)     ;GET VALUE
00216            LD      DE,-128         ;SET UP MOD 128
00217   SET1:    OR      A               ;CLEAR CARRY
00218            ADC     HL,DE           ;THIS INSTR SETS FLAGS
00219            JP      P,SET1          ;NOT DONE YET
00220            OR      A               ;CLEAR CARRY
00221            SBC     HL,DE           ;ADD BACK 128
00222            LD      (XCOORD),HL
00223            LD      HL,(YCOORD)     ;GET Y COORD = MOD 48
00224            LD      DE,-48
00225   SET2:    OR      A               ;CLEAR CARRY
00226            ADC     HL,DE           ;YC=YC-48
00227            JP      P,SET2          ;KEEP GOING
00228            OR      A
00229            SBC     HL,DE           ;YC=YC+48
00230            LD      (YCOORD),HL
00231            LD      A,(XCOORD)      ;NEED ONLY LOW BYTE
00232            LD      E,A
00233            LD      A,(YCOORD)      ;SAME HERE
00234            SRL     E               ;X/2
00235            LD      D,0             ;D=MOD(X,2)
00236            JR      NC.SET3         ;NO REMAINDER
00237            INC     D               ;YES REMAINDER
00238   SET3:    LD      B,-1            ;SET UP DIVIDE LOOP
00239   SET4:    INC     B               ;QUOTIENT Y/3
00240            SUB     3               ;REMAINDER WILL BE IN A
00241            JP      P,SET4
00242            ADD     A,3             ;FORM REMAINDER
00243
00244   ;        Y/3 = LINE NUMBER
00245   ;        X/2 = COLUMN NUMBER
00246   ;        Y MOD 3 = ROW NUMBER IN GRAPHIC BYTE
00247   ;        X MOD 2 = COLUMN NUMBER IN GRAPHIC BYTE
00248   ;        VIDEO ADDR = 3C00H + 64 * LINE + COLUMN
00249   ;        BIT POS = 2 * ROW + COLUMN
00250
00251            RLCA                    ;ROW * 2
00252            ADD     A,D             ;ROW * 2 + COLUMN
00253            LD      C,A             ;SAVE BIT NUMBER
00254            LD      L,B             ;GET LINE NUMBER
00255            LD      H,0             ;TO HL REGISTER
00256            ADD     HL,HL
00257            ADD     HL,HL
00258            ADD     HL,HL
00259            ADD     HL,HL
00260            ADD     HL,HL
00261            ADD     HL,HL           ;64 * LINE NUMBER
00262            LD      D,0             ;DE = COLUMN
00263            ADD     HL,DE           ;64*LINE+COL
00264            LD      DE,3C00H
00265            ADD     HL,DE           ;VIDEO ADDRESS
00266            LD      B,0             ;BC = BIT NUMBER
00267            RET
00268
00269            DSEG
00270   XCOORD:  DW      0               ;DO NOT  DO NOT  DO NOT
00271   YCOORD:  DW      0               ;CHANGE THE POSITION OF
00272   ZVAL:    DW      0               ;THESE 3 VALUES
00273            CSEG
00274
00275
00276   ;        SUBROUTINE PLOT(IX,IY,I2) - PLOT A GRAPHIC
00277   ;                POINT AT THE SCREEN LOCATION DEFINED BY
```

Listing 1 continues

Listing 1 continued

```
00278   ;               IX,IY.  IX IS REDUCED TO (IX MOD 128)
00279   ;               AND IY IS REDUCED TO (IY MOD 48) PRIOR
00280   ;               TO USE.  IF IZ IS ODD, A "SET" FUNCTION
00281   ;               IS PERFORMED; IF IZ IS EVEN - "RESET".
00282   ;       EG.  CALL PLOT(50,25,1)
00283
00284           ENTRY   PLOT
00285   PLOT:   CALL    SETUP           ;SET UP BYTE AND BIT #
00286           LD      A,(HL)          ;GET VIDEO BYTE
00287           OR      A               ;TEST FOR GRAPHIC BYTE
00288           JP      M,PLOT1         ;OK - BYTE IS GRAPHIC
00289           LD      (HL),80H        ;MAKE IT GRAPHIC BLANK
00290   PLOT1:  LD      A,(ZVAL)        ;GET FUNCTION
00291           AND     1               ;TEST FOR SET/RESET
00292           JR      Z,PLOT2         ;PERFORM RESET
00293           LD      IX,MASK1        ;GET MASK FOR SET
00294           ADD     IX,BC           ;PROPER MASK
00295           LD      A,(HL)          ;GET GRAPHIC BYTE
00296           OR      (IX)            ;SET PROPER BIT
00297           LD      (HL),A
00298           RET
00299   PLOT2:  LD      IX,MASK2        ;GET MASK FOR RESET
00300           ADD     IX,BC           ;PROPER MASK ADDRESS
00301           LD      A,(HL)          ;GET GRAPHIC BYTE
00302           AND     (IX)            ;RESET BRIDGE
00303           LD      (HL),A          ;RESTORE BYTE IN VIDEO
00304           RET
00305
00306   ;       DATA MASKS FOR SET/RESET
00307
00308           DSEG
00309   MASK1:  DB      1,2,4,8,16,32
00310   MASK2:  DB      0FEH,0FDH,0FBH,0F7H,0EFH,0DFH
00311           CSEG
00312
00313
00314   ;       LOGICAL FUNCTION POINT(X,Y) - TEST THE GRAPHIC
00315   ;               POINT AT SCREEN LOCATION (X,Y) AND
00316   ;               RETURN A FORTRAN .TRUE. VALUE IF SET,
00317   ;               .FALSE. OTHERWISE.  .TRUE. IS A -1, AND
00318   ;               .FALSE. IS 0.
00319   ;       EG.  IF(POINT(50,25)) CALL PLOT(50,25,0)
00320
00321           ENTRY   POINT
00322   POINT:  CALL    SETUP           ;SET UP BYTE AND BIT #
00323           LD      IX,MASK1        ;GET PROPER MASK
00324           ADD     IX,BC
00325           LD      A,(HL)          ;GET SCREEN BYTE
00326           AND     (IX)            ;TEST FOR "ON"
00327           LD      L,0             ;SET UP RETURN
00328           JR      Z,POINT2        ;BIT IS RESET
00329           DEC     L               ;SET -1 FOR RETURN
00330   POINT2: LD      A,L             ;PROPER VALUE FOR RET
00331           RET
00332
00333           END
```

Continued from p. 189

routine returns properly to the calling program. CLS issues the codes 1CH (home cursor) and 1FH (clear to end of frame) to clear the video screen.

Integer function IRAND (lines 12–27) generates an integer random value between 1 and the maximum value passed to the function. Lines 19–24 use the pointer address in the HL register to load the DE register with the 16-bit integer value passed. It is up to you to ensure that the calling program sends IRAND only integer values.

Basic uses the area just above 4000H as a workspace. Since USRLIB uses Basic ROM routines, this workspace is available to it. The arithmetic routines use the storage beginning at 411DH as an accumulator (ACC). The byte at 40AFH specifies the type of the accumulator (NTF) as integer (2), string (3), single-precision (4), and double-precision (8).

The ROM routine at 0A9H stores the integer value contained in the HL register in the ACC (at 412H for integers) and sets NTF to 2 (for integer). The ROM routine at 14C9H (RND) accepts any type of numerical input, as long as the ACC and NTF are set appropriately.

The program generates a random number as follows: if the ACC is zero on entry, generate a single-precision value between zero and 1; if the ACC is not zero, truncate to integer using CINT and generate an integer value in the range from 1 to the maximum specified. In either case, the result is returned in the ACC as a single-precision result and NTF is set to 4. The routine at 0A7FH (CINT) converts the number to an integer (if it's less than 32767) and returns the result in the HL registers and in the ACC. If you use a maximum value that is negative, you get an error message generated by the RND function and the computer may reboot.

Subroutine RANDOM (lines 30–35) calls the ROM routine at 01D3H to reseed the random number generator using the dynamic memory refresh register.

Logical function GETCH (lines 38–46) calls the ROM routine at 0049H to scan the keyboard. Control does not return to the calling program until you press a key (the routine at 002BH, however, returns zero if no key is pressed). The call to 0049H returns an 8-bit value in the A register.

Subroutine DISPL (lines 49–57) uses the routine at location 0033H to display the character in the A register. The 8-bit

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code can be anything the video driver recognizes.

Subroutine CRLF (lines 60–66) uses a variation of DISPL to send a carriage-return, line-feed character (0DH) to the routine at location 0033H.

Subroutine OUTSTR (lines 69–85) sends a string of characters (which may be an array in Fortran or a string in quotes) to the video, character by character. If the string is terminated by $, control simply returns to the calling program. If the string is terminated by %, a CRLF code is sent to the video screen. You can substitute any termination characters you like—simply change the codes in lines 79 and 81.

Subroutine PTC (lines 88–120) addresses the screen video locations by line and column number. The correct video screen position is calculated by the following formula:

$$\text{Cursor} = 3C00H + 64 \times \text{Line} + \text{Column}$$

The resultant screen address is stored in vector location 4020H, the address of the system video cursor.

Subroutine OUTINT (lines 123–144) converts the 16-bit integer value passed as its parameter to an ASCII string which is then displayed on the video screen at the location specified by the system cursor. ROM routine 0A9AH takes the value of the 16-bit integer in the HL register, stores it in the ACC (4121H), and sets NTF (40AFH) to 2. The ROM routine that begins at 0FBDH converts the contents of the ACC, NTF (it does not matter if they are integer, single-precision, or double-precision; however, ACC and NTF must be correctly set) to an ASCII string representing the value. As in the Basic STR$ routine, the value is returned with a leading blank. On return, the HL register contains the address of the leading blank and the string ends with 00H.

This ROM conversion routine has two entry points: one at 0FBDH and the other at 0FBEH. The difference is in the format of the resulting string. At 0FBDH, the string is just converted to ASCII. An entry at location 0FBEH expects to have the A, B, and C registers set according to the values presented in Table 1. Many functions of the Basic PRINT USING statement are simply accomplished by judicious use of the routine at 0FBEH.

Integer function INNUM (lines 147–175) uses the keyboard input function at

```
FORTRAN-80 VER. 3.34 COPYRIGHT 1978 (C) BY MICROSOFT
BYTES: 20186
CREATED: 04-NOV-79
00001            PROGRAM BRKOUT
00002            INTEGER XPOS,YPOS,PPOS,XDIR,YDIR,SCORE,SPEED
00003            INTEGER SPVAR,FLAG,BEST,STP
00004            LOGICAL PEEK,GETCH
00005            COMMON /GLOBAL/ XPOS,YPOS,PPOS,XDIR,YDIR,SCORE,
00006           X           SPVAR,NB,SPEED,FLAG,BEST
00007            CALL RANDOM
00008            STP=0
00009            BEST=0
00010   100      PPOS=28
00011            SPVAR=0
00012            CALL INIT
00013            CALL PSET
00014            DO 99 NBP=1,NB
00015            L=100+IRAND(250)
00016            DO 10 K=1,L
00017            DO 9 M=1,100
00018   9        CONTINUE
00019            CALL PADDLE
00020   10       CONTINUE
00021            CALL PTC(0,60)
00022            CALL OUTINT(NBP)
00023            SPVAR=5
00024            XDIR=1
00025            IF(IRAND(2).EQ.1) XDIR=-1
00026            YDIR=1
00027            YPOS=29
00028            XPOS=2+IRAND(58)
00029   50       DO 20 K=1,3
00030            CALL PADDLE
00031   20       CONTINUE
00032            CALL BALL
00033            CALL CKGAME
00034            CALL DELAY
00035            IF((PEEK(X'3840').AND.4).EQ.0) GO TO 25
00036            FLAG=1
00037            NBP=NB
00038   25       IF(FLAG.EQ.0) GO TO 50
00039            DO 30 K=1,20
00040            CALL BOP
00041   30       CONTINUE
00042   99       CONTINUE
00043            BEST=MAX0(BEST,SCORE)
00044            CALL PTC(8,23)
00045            CALL OUTSTR(' RUN GAME AGAIN? $')
00046   40       KEY=GETCH(0)
00047            IF(KEY.NE.78 .AND. KEY.NE.89) GO TO 40
00048            IF(KEY.EQ.78) STP=1
00049            IF(STP.EQ.0) GO TO 100
00050            END
```

Program Listing 2. BREAKOUT

ROM address 05D9H to read the keyboard to an internal buffer. The cursor is at the current screen address (location 4020H) and the characters echo from the keyboard to the video. Input is terminated with the break or enter keys. The routine at 05D9H expects the HL register to contain the starting address of the buffer and the B register to contain the maximum character input. On return, register HL still points to the start of the buffer. The carry flag is set to signify that the break key was pressed, or reset for normal input termination by pressing the enter key. Register B contains the length of the actual input string and register C contains the original maximum length.

INNUM will return with a function value of zero if either the break key was pressed or a null (zero length) string was input. If a string is present, the routine at ROM address 0E6CH converts the string to its minimal binary configuration. If it fits in integer format, it is converted to 16-bit integer. Otherwise, it is converted to single-precision or double-precision. Finally, CINT at ROM address 0A7FH converts to integer and loads the HL register.

The rest of Listing 1 is the set of rou-

Register	Explanation
A	Edit control, specified by bit number:
	Bit 0 = 1 Generate exponential notation ±d.dddE±dd (also see B and C registers for formatting).
	Bit 1 Not used.
	Bit 2 = 1 Generate trailing sign if the value is negative.
	Bit 3 = 1 Force sign to be generated, "+" for positive numbers, "−" for negative numbers. The sign may be leading or trailing.
	Bit 4 = 1 Generate leading "$" immediately to the left of the leading digit.
	Bit 5 = 1 Generate leading "*" filler.
	Bit 6 = 1 Insert commas into string.
	Bit 7 = 1 Edit according to options specified.
B	Specifies the number of digits to the left of the decimal point. The field +ddd.ddddd would be converted with B set to 3.
C	Specifies the number of digits to follow the decimal point. The field above would be printed using C register set to 5.

Note: These register conventions define the editing to be performed on the number in the ACC, NTF and are used with the entry at 0FBEH. The entry to this routine at 0FBDH is with an XOR A instruction which disables editing.

Table 1

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tines used to do Set, Reset, and Point graphics on the TRS-80: SETUP, PLOT, and POINT. The program uses no ROM routines or self-modifying code here. If you never send it anything except the proper range number, remove the code to form MOD(x,128) and MOD(y,48) to speed it up.

SETUP (lines 178–273), a subroutine called by PLOT and POINT, uses the three Fortran parameters (X, Y, and Z) to store associated values in temporary locations. SETUP calculates the line and column numbers of the applicable graphics byte from the X and Y inputs (see lines 244–249 for formulas used) and, as a by-product of these calculations, extracts the row and column numbers of the graphics pixel in the video byte. This information is used to calculate the graphics byte video screen address and an index into the table of masks to be used by PLOT and POINT for the appropriate bit to be set, reset, or tested.

"One disadvantage of Fortran is its limited ability to handle expressions as part of a Do statement."

Subroutine PLOT (lines 276-311) calls SETUP to decode the input parameters of X, Y, and the set/reset flag. Then it examines the graphics byte to see if it has bit 7 turned on (a graphics byte greater than 80H) and forces it to a graphics blank (80H) if the byte was a character (less than 80H). The low-order bit of the third parameter (set/reset flag) is examined and the set or reset action is taken by using the appropriate mask and logical And or Or operations.

Logical function POINT (lines 314–331) calls SETUP to decode the two input parameters, X and Y. The third parameter generated by SETUP is ignored as it is not used by the bit-testing routine. Once the parameters have been decoded, the data masks are used to mask off and to test the bit in question. A Fortran value of −1 (true) is returned if the point is on, and zero (false) if the point is off.

Program Listing 3. BREAKOUT/CMD

```
*** USRLIB *** FORTRAN EXTENSIONS FOR TRS-80 ***       MACRO-80 3.34   04-NOV-79
     PAGE    1
00001            PROGRAM BRKOUT
00002            INTEGER XPOS,YPOS,PPOS,XDIR,YDIR,SCORE,SPEED
00003            INTEGER SPVAR,FLAG,BEST,STP
00004            LOGICAL PEEK,GETCH
00005            COMMON /GLOBAL/ XPOS,YPOS,PPOS,XDIR,YDIR,SCORE,
00006           X          SPVAR,NB,SPEED.FLAG,BEST
00007            CALL RANDOM
00008            STP=0
00009            BEST=0
00010   100      PPOS=28
00011            SPVAR=0
00012            CALL INIT
00013            CALL PSET
00014            DO 99 NBP=1,NB
00015            L=100+IRAND(250)
00016            DO 10 K=1,L
00017            DO 9 M=1,100
00018   9        CONTINUE
00019            CALL PADDLE
00020   10       CONTINUE
00021            CALL PTC(0,60)
00022            CALL OUTINT(NBP)
00023            SPVAR=5
00024            XDIR=1
00025            IF(IRAND(2).EQ.1) XDIR=-1
00026            YDIR=1
00027            YPOS=29
00028            XPOS=2+IRAND(58)
00029   50       DO 20 K=1,3
00030            CALL PADDLE
00031   20       CONTINUE
00032            CALL BALL
00033            CALL CKGAME
00034            CALL DELAY
00035            IF((PEEK(X'3840').AND.4).EQ.0) GO TO 25
00036            FLAG=1
00037            NBP=NB
00038   25       IF(FLAG.EQ.0) GO TO 50
00039            DO 30 K=1,20
00040            CALL BOP
00041   30       CONTINUE
00042   99       CONTINUE
00043            BEST=MAX0(BEST,SCORE)
00044            CALL PTC(8,23)
00045            CALL OUTSTR(' RUN GAME AGAIN? $')
00046   40       KEY=GETCH(0)
00047            IF(KEY.NE.78 .AND. KEY.NE.89) GO TO 40
00048            IF(KEY.EQ.78) STP=1
00049            IF(STP.EQ.0) GO TO 100
00050            END
00051            SUBROUTINE LINE(NUMBER)
00052            CALL PTC(NUMBER,0)
00053            CALL DISPL(30)
00054            RETURN
00055            END
00056            SUBROUTINE BOP
00057            DO 10 I=1,25
00058            CALL OUT(255,1)
00059            DO 5 J=1,10
00060   5        CONTINUE
00061            CALL OUT(255,2)
00062            DO 10 J=1,10
00063   10       CONTINUE
00064            RETURN
00065            END
00066            SUBROUTINE FILL(ISTART,ICOUNT,ICHAR)
00067            K=ISTART+ICOUNT-1
00068            DO 10 I=ISTART,K
```

Listing 3 continues

Breakout

In the July 1981 issue of *80 Microcomputing*, I published an article called "Modifying Tiny Pascal For Disk." As part of that article, I presented a Tiny Pascal version of the game Breakout. This Fortran version of Breakout demonstrates the functions and subroutines in USRLIB.

Communication between subroutines in the Fortran version is done as global variables in a common block. The variables are listed in a block which may be made common to any routine by naming that block. This convenient procedure reduces the overhead in the Fortran program on parameter linkage.

One disadvantage of Fortran is its limited ability to handle expressions as part of a Do statement or as the subscript used for an array. This causes the use of temporary variables in the Fortran program which detract from the clarity of the resulting program.

Some characters displayed in INIT are greater than 192 (C0H). The Level II Basic reference manual notes that any character greater than 192 (C0H) is displayed as a Tab for the difference of 192 and the value (202 is equivalent to TAB(10) print command).

Creating and Testing USRLIB

To create USRLIB/MAC, enter the source code in Listing 1 using Edit (the editor that comes as part of the Macro-80 assembler). Exit the editor with the E command to write the source file to the disk. If you don't name the file USRLIB/MAC, make sure you use the extension /MAC so the Macro-80 assembler is able to find it.

Assemble USRLIB/MAC using the Macro-80 assembler and create a relocatable file (/REL file) and a listing file (/LST file) with the Macro-80 command:

Continues on p. 196

Listing 3 continued

```
00069            CALL POKE(I,ICHAR)
00070    10      CONTINUE
00071            RETURN
00072            END
00073            SUBROUTINE PCLR
00074            INTEGER PPOS
00075            COMMON /GLOBAL/ IXPOS,IYPOS,PPOS,IXDIR,IYDIR
00076            COMMON /GLOBAL/ ISC,ISPV,NB,ISPD,IFL,IBEST
00077            CALL FILL(16320+PPOS,8,32)
00078            RETURN
00079            END
00080            SUBROUTINE PSET
00081            INTEGER PPOS
00082            COMMON /GLOBAL/ IXPOS,IYPOS,PPOS
00083            CALL FILL(16320+PPOS,8,176)
00084            RETURN
00085            END
00086            SUBROUTINE PADDLE
00087            INTEGER PPOS
00088            LOGICAL PEEK
00089            COMMON /GLOBAL/ IXPOS,IYPOS,PPOS
00090            IF(PEEK(X'3840').NE.32) GO TO 100
00091            CALL PCLR
00092            PPOS=MAX0(2,PPOS-1)
00093            CALL PSET
00094    100     IF(PEEK(X'3840').NE.64) RETURN
00095            CALL PCLR
00096            PPOS=MIN0(54,PPOS+1)
00097            CALL PSET
00098            RETURN
00099            END
00100            SUBROUTINE DSET(X,Y)
00101            INTEGER X,Y
00102            K=X+X
00103            CALL PLOT(K,Y,1)
00104            CALL PLOT(K+1,Y,1)
00105            RETURN
00106            END
00107            SUBROUTINE DCLR(X,Y)
00108            INTEGER X,Y
00109            K=X+X
00110            CALL PLOT(K,Y,0)
00111            CALL PLOT(K+1,Y,0)
00112            RETURN
00113            END
00114            LOGICAL FUNCTION DTEST(X,Y)
00115            INTEGER X,Y
00116            LOGICAL POINT
00117            DTEST=0
00118            IF(POINT(X+X,Y).AND.POINT(X+X+1,Y)) DTEST=1
00119            RETURN
00120            END
00121            SUBROUTINE XCHK
00122            INTEGER XPOS,XDIR
00123            COMMON /GLOBAL/ XPOS,IYPOS,IPPOS,XDIR
00124            IF(XPOS.GE.2) GO TO 100
00125            XDIR=-XDIR
00126            XPOS=2
00127            CALL BOP
00128            RETURN
00129    100     IF(XPOS.LE.61) RETURN
00130            XDIR=-XDIR
00131            XPOS=61
00132            CALL BOP
00133            RETURN
00134            END
00135            SUBROUTINE YCHK
00136            INTEGER YPOS,YDIR,SPVAR
00137            COMMON /GLOBAL/ IX,YPOS,IP,IXD,YDIR,IS,SPVAR
00138            IF(YPOS.GE.5) GO TO 100
00139            YDIR=1
00140            YPOS=5
00141            SPVAR=1
00142            CALL BOP
00143            RETURN
00144    100     IF(YPOS.LT.23) SPVAR=MIN0(SPVAR,4)
00145            IF(YPOS.LT.19) SPVAR=MIN0(SPVAR,3)
00146            IF(YPOS.LT.15) SPVAR=MIN0(SPVAR,2)
00147            RETURN
00148            END
00149            SUBROUTINE PCHK
00150            INTEGER XPOS,YPOS,PPOS,XDIR,YDIR,FLAG
00151            COMMON /GLOBAL/ XPOS,YPOS,PPOS,XDIR,YDIR,
00152           X IS,ISP,NB,ISPD,FLAG
00153            FLAG=0
00154            IF(YPOS.LT.47) RETURN
00155            YPOS=46
00156            K=XPOS-PPOS
00157            IF(K.LT.0 .OR. K.GE.8) GO TO 100
00158            YDIR=-1
00159            CALL BOP
00160            K=K+1
00161            GO TO (10,11,11,11,12,12,12,13),K
00162    10      XDIR=-2
00163            RETURN
00164    11      XDIR=-1
00165            RETURN
00166    12      XDIR=1
00167            RETURN
00168    13      XDIR=2
00169            RETURN
00170    100     FLAG=1
00171            RETURN
00172            END
00173            SUBROUTINE INIT
00174            INTEGER SPEED.SCORE,BEST
00175            LOGICAL PEEK,GETCH
00176            COMMON /GLOBAL/ IX,IY,IP,IXD,IYD
00177            COMMON /GLOBAL/ SCORE,IS,NB,SPEED,IFL,BEST
```

Listing 3 continues

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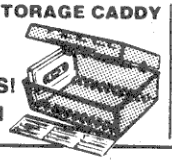

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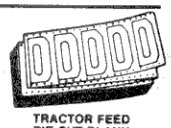

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Continued from p. 194

M80 USRLIB,USRLIB=USRLIB

If you find assembly errors, compare the source code to Listing 1 and use the editor to correct errors.

When assembly is complete, you've created USRLIB in relocatable format.

To test USRLIB, create the source file for BREAKOUT/FOR from Listing 2 using Edit just as you did for USRLIB/MAC. Compile BREAKOUT/FOR using the Fortran command:

F80 BREAKOUT,BREAKOUT=BREAKOUT-N

Compile-time errors are displayed on the screen between the subprogram names. Note the line number and the type of error for later correction. The -N switch at the end of the F80 command causes the compiler to suppress the Assembly-code generation in the listing file output so you don't run out of disk space.

Once you have created Breakout and USRLIB, link them together with the L80 linkage editor. If you have two disk drives, use the following command at the * prompt in L80:

*BREAKOUT,USRLIB,FORLIB-S,
BREAKOUT-N,-E

This command will link the two modules and extract whatever routines are necessary from FORLIB/REL (the Fortran relocatable subroutine library). Once all the linkage editing is completed, BREAKOUT/CMD is assigned as the module's name and control returns to DOS Ready. The linkage editor then writes the linked modules to the disk under the name BREAKOUT/CMD (see Listing 3). ■

J. B. Harrell can be reached at the Portsmouth Naval Shipyard, Qtrs. 192-A, Portsmouth, NH 03801.

Listing 3 continued

```
00178           CALL CLS
00179           CALL PTC(1,22)
00180           CALL OUTSTR('< B R E A K O U T >$')
00181           CALL PTC(4,10)
00182           CALL OUTSTR('<BREAKOUT> IS AN EXCITING, FAST-ACTION GAME%')
00183           CALL DISPL(202)
00184           CALL OUTSTR('WHERE YOU USE THE LEFT AND RIGHT ARROWS TO%')
00185           CALL DISPL(202)
00186           CALL OUTSTR('MOVE THE PADDLE AND TRY TO MAKE THE BALL%')
00187           CALL DISPL(202)
00188           CALL OUTSTR('BREAK OUT OF THE WALLED-IN AREA ON THE%')
00189           CALL DISPL(202)
00190           CALL OUTSTR('PLAYING FIELD.  sOUNDS ACCOMPANY EACH OF%')
00191           CALL DISPL(202)
00192           CALL OUTSTR('THE BALL''s COLLISIONS WITH A SOLID OBJECT.%')
00193           CALL CRLF
00194           CALL DISPL(202)
00195           CALL OUTSTR('PRESS <ENTER> WHEN YOU ARE READY TO BEGIN.%')
00196   101     IF(GETCH(0) .NE. 13) GO TO 101
00197           CALL CLS
00198           CALL PTC(3,22)
00199           CALL OUTSTR('< B R E A K O U T >%')
00200           CALL LINE(7)
00201           CALL OUTSTR('SPEED (1-10, 1 IS FASTEST): $')
00202           SPEED=INNUM(2)
00203           CALL LINE(10)
00204           CALL OUTSTR('NUMBER OF BALLS (1-50): $')
00205           NB=INNUM(2)
00206           CALL CLS
00207           SPEED=MIN0(MAX0(SPEED,1),10)
00208           NB=MIN0(MAX0(NB,1),50)
00209           DO 10 I=0,63
00210           CALL DSET(I,3)
00211           CALL DSET(I,4)
00212   10      CONTINUE
00213           DO 20 I=3,47
00214           CALL DSET(0,I)
00215           CALL DSET(1,I)
00216           CALL DSET(62,I)
00217           CALL DSET(63,I)
00218   20      CONTINUE
00219           CALL FILL(15616,320,191)
00220           SCORE=0
00221           CALL LINE(0)
00222           CALL OUTSTR('BREAKOUT                    SCORE: 0     BEST:$')
00223           CALL OUTINT(BEST)
00224           CALL PTC(0,54)
00225           CALL OUTSTR('BALL:$')
00226           RETURN
00227           END
00228           SUBROUTINE CLR
00229           INTEGER XPOS,YPOS,YDIR,SCORE
00230           COMMON /GLOBAL/ XPOS,YPOS,IP,IX,YDIR,SCORE
00231           K=((XPOS-2).AND.124)+2
00232           J=K+3
00233           DO 10 I=K,J
00234           CALL DCLR(I,YPOS)
00235   10      CONTINUE
00236           SCORE=SCORE+IABS(YPOS-27)
00237           CALL PTC(0,33)
00238           CALL OUTINT(SCORE)
00239           CALL BOP
00240           YDIR=-YDIR
00241           RETURN
00242           END
00243           SUBROUTINE CKBALL
00244           INTEGER XPOS,YPOS,XDIR,YDIR
00245           LOGICAL DTEST
00246           COMMON /GLOBAL/ XPOS,YPOS,IP,XDIR,YDIR
00247           YPOS=YPOS+YDIR
00248           XPOS=XPOS+XDIR
00249           CALL XCHK
00250           CALL YCHK
00251           CALL PCHK
00252           IF(DTEST(XPOS,YPOS).NE.0) CALL CLR
00253           RETURN
00254           END
00255           SUBROUTINE BALL
00256           INTEGER XPOS,YPOS,FLAG
00257           COMMON /GLOBAL/ XPOS,YPOS,IP,IXD,IYD,IS,ISP,
00258          X          NB,ISPD,FLAG
00259           CALL DCLR(XPOS,YPOS)
00260           CALL CKBALL
00261           IF(FLAG.EQ.0) CALL DSET(XPOS,YPOS)
00262           RETURN
00263           END
00264           SUBROUTINE CKGAME
00265           INTEGER SCORE
00266           COMMON /GLOBAL/ IX,IY,IP,IXD,IYD,SCORE
00267           IF(MOD(SCORE,1800).EQ.0)CALL FILL(15616,320,191)
00268           RETURN
00269           END
00270           SUBROUTINE DELAY
00271           INTEGER SPVAR,SPEED
00272           BYTE I,J,K,M
00273           COMMON /GLOBAL/ IX,IY,IP,IXD,IYD,IS,
00274          X  SPVAR,NB,SPEED
00275           K=SPEED * 3
00276           M=SPVAR * 50
00277           DO 10 I=1,K
00278           DO 10 J=1,M
00279   10      CONTINUE
00280           RETURN
00281           END
```


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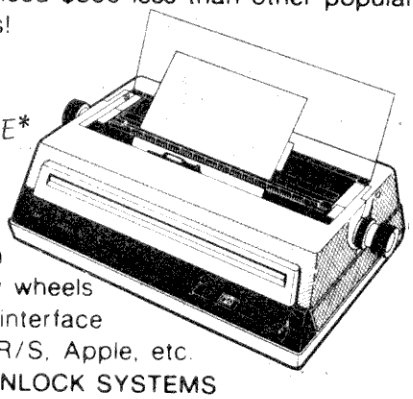

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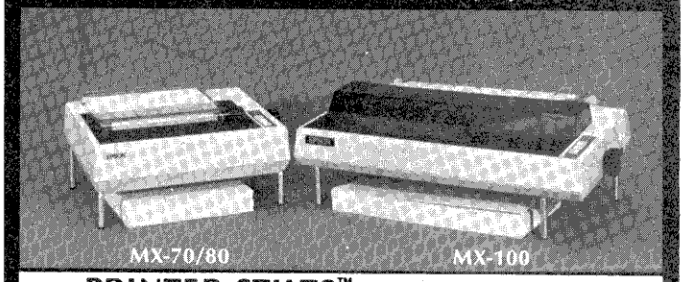

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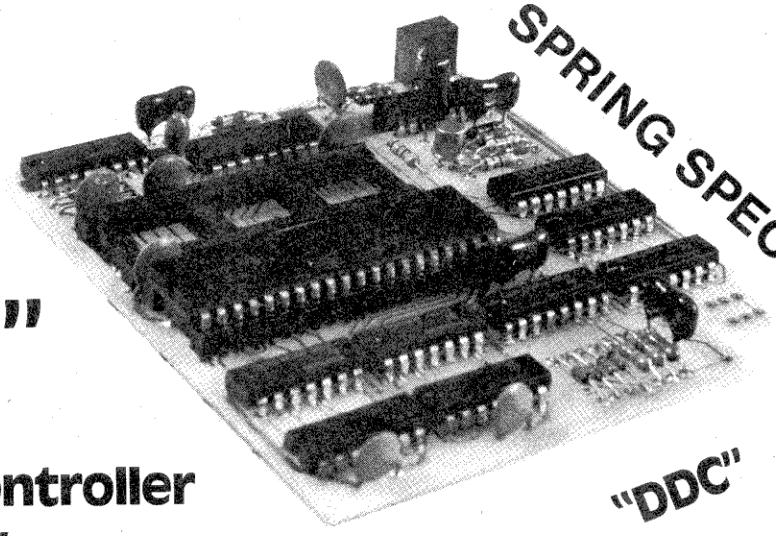

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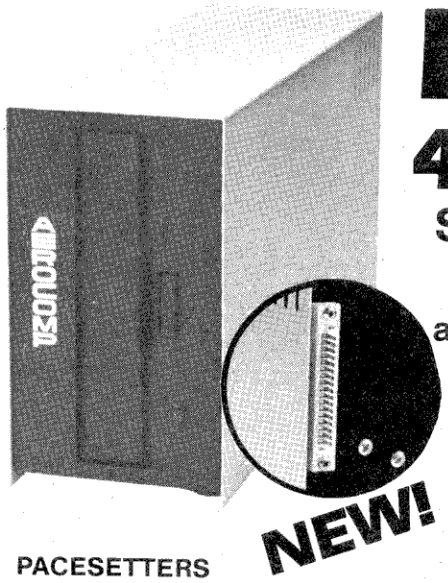

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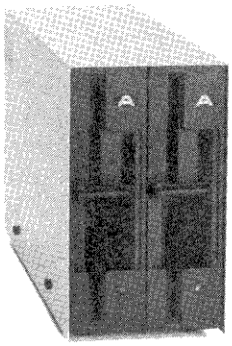

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Basic, Faster and Readable—Part II

by John Corbani

Conditional tests are easier when you tailor the logic to the expected input and increase the speed by utilizing MBasic. Here's how.

The first part of this series (*80 Micro*, June 1983, p. 104) touched on Basic source code formatting, print techniques, and some keyboard routines. Now it's time to take a look at how the MBasic interpreter works.

Basic programs consist of a continuous sequence of numbered command statements. Unless otherwise instructed by a GOTO n statement, Basic interprets and executes commands from the lowest numbered statement until it encounters STOP, END, an error condition, or until the operator presses the break key. Each numbered statement holds up to 255 characters and a program is formatted into as many physical lines as desired. The instructions in each statement are interpreted and executed in straightforward left-to-right, top-to-bottom order. (A rigid priority sequence is followed in arithmetic operations, but the left-to-right sequence holds in most cases.)

Basic statements are held in memory in a condensed format significantly different from the listing on the screen or printer. All Basic words are stored and evaluated during execution as 1-byte characters. The ASCII format is seen on the screen for readability only. Program lines are condensed and stored immediately after the programmer presses the enter key. List and LLIST translate the condensed code back to ASCII. Disk users can save programs in the ASCII format by adding ,A to the end of a Save command.

The coding of Basic key words is the secret of MBasic's high speed. The other elements of a Basic statement are operator-entered constants (string or numeric), variables (string or numeric), and remarks. These elements are stored in ASCII in all cases. Every statement has a minimum overhead consisting of the address of the next statement number as a 2-byte integer, the statement number stored as a 2-byte integer, and a statement terminator. The terminator is a single byte with a zero value for all statements except the last one in a program. The terminator of the last statement in a program is 2 zero bytes in succession. The detail sequence is next statement address—LSB, MSB (least significant byte, most significant byte); the statement number—LSB, MSB; the executable body of the statement; and the terminator.

While execution of a program normally runs from top to bottom, the branching statements GOTO and GOSUB allow the Basic programmer to execute statements in any sequence he chooses. If...Then...Else and On statements may precede branching statements to allow conditional as well as unconditional program branches. Additional condition statements are available with MBasic 5.n, but the ones mentioned here create virtually all program structures.

The above information is available in most Basic instruction manuals and is fine as far as it goes. However, as mentioned in part 1 of this series, the interpretation and execution of computer Basic statements do not always go smoothly. The direct execution of an immediate statement generally follows rigorous rules. Errors are well flagged by the interpreter and the programmer

```
10 PRINT"INPUT A";:INPUTA
20 IFA>29ANDA<40THENPRINT"IN THE THIRTIES":GOTO10
30 IFA<30THENPRINT"LESS THAN 30": GOTO 10
40 IF A<20 PRINT "LESS THAN 20": GOTO 10
50 PRINT "TOO BIG": GOTO 10
```

Figure 1

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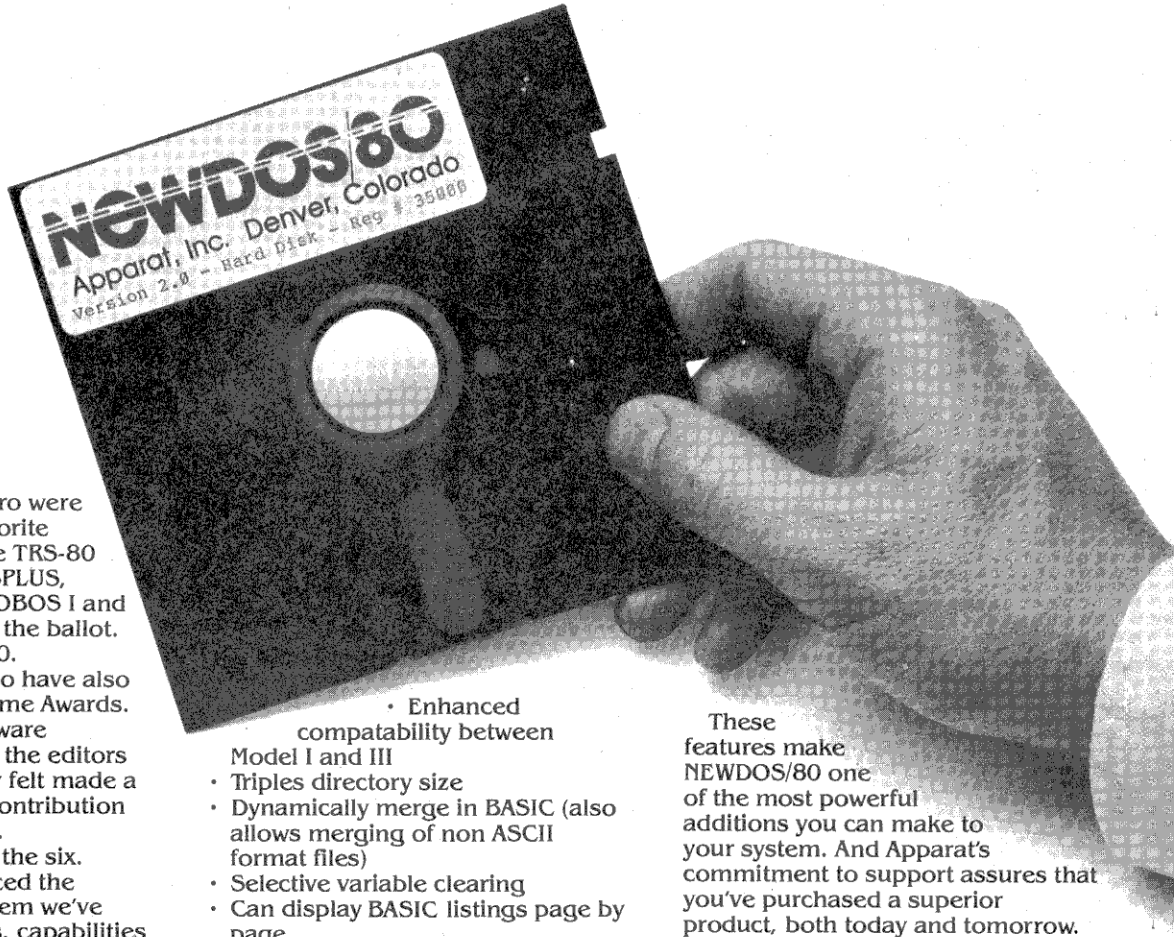

The readers of 80 Micro were asked to select their favorite operating system for the TRS-80 Model I&III. LDOS, DOSPLUS, TRSDOS, MULTIDOS, WOBOS I and NEWDOS/80 were all on the ballot. They picked NEWDOS/80.

The editors of 80 Micro have also awarded their Hall of Fame Awards. From among every software package on the market, the editors picked only six that they felt made a lasting and significant contribution to the TRS-80 computer. NEWDOS/80 was one of the six.

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receives explicit notification of any problems found. Conditional tests are another story and these are the focus of this month's effort.

Figure 1 is a hypothetical test sequence illustrating some of the situations that arise in evaluating a variable. Lines 10, 20, and 30 are technically correct, but they process data the hard way and are difficult to read. Line 40 runs as fast as line 30, is more readable, and is only one character longer.

A number of other improvements are possible by thinking about the rules in detail. Then is a conditionally optional key word. Line 40 is not grammatically correct, but it does execute. Check for simple English sense before using any optional key words. If any Basic word is required after a conditional test, Then is unnecessary. In addition to dropping the Then, line 40 has spaces inserted between Basic words only where readability is improved.

There are five statements in the above routine, each with its own 5-byte overhead. There are also four identical GOTO 10 statements. This routine executes slowly for most input. Execution speed is governed by the way Basic reads an If statement. The interpreter reads the If statement and then evaluates the condition or conditions. If the condition is true, the statement after the real or implied Then is carried out, and execution either proceeds as directed by a GOTO or goes on to the next numbered statement. If the statement is false, the rest of the line is checked for an Else. If none is found, execution continues to the next statement. If there are a lot of tests, most of them will be false and false tests are read to the end. As long as they have to be read, give the interpreter something to find.

Many techniques can clean up and speed up this routine. Look at Fig. 2 to see how to improve the code.

Everything is in two readable statements. A is input and evaluated, and the proper message printed in one statement. The optional print feature of the Input command should be used whenever possible.

Perform tests in the order that requires the minimum number of tests. The If statements each have their own line with Else used as the standard end of a logical statement and physical line. Lines are indented only enough to provide a flush-left edge of executable code. Statement numbers stand out clearly, making it easy to find the first line of a statement. After any Print command, the interpreter drops directly to the single GOTO 10 in line 20. The AND in the original statement 20 was eliminated by reworking the sequence.

The sequence is frequently listed in tutorial manuals in a form similar to that in Fig. 3. The extra white paper and the overhead of this format serve no useful purpose. This simple routine uses 15 of your 16 screen lines. On-screen editing of such code is virtually impossible without a printout by your side. Compacting the code reduces required memory and increases execution speed.

A possible complication in If...Then...Else statements can occur when Boolean operators are used in complex evaluations. Remember that a test failure causes a search for an Else before jumping to the next statement. Before that search begins, the tests themselves are always completed. In a complex evaluation, the whole evaluation is performed even if the first part of an AND is not true.

Figure 4 (a) is a potential trouble spot. If N = 0, the first test will fail, but a division by zero is attempted anyway and an error occurs. Figure 4 (b) shows how to break things up when such an error is possible. Adding formatting characters is justified when statements get this messy. Complete thoughts or lines of thought should have their own lines if you can afford them. Once again, the logic is tailored for the expected input. Figures 4 (a) and 4 (b) expect A to be greater than zero most of the time. If A is expected to be zero most of the time, 4 (c) is a shorter and faster routine. Note that one line of thought per physical line is used.

Any program's execution speed, no matter what the language, generally ex-

```
10 INPUT "␣INPUT A"; A:
   IF A<20 PRINT "LESS THAN 20" ELSE
   IF A<30 PRINT "LESS THAN 30" ELSE
   IF A<40 PRINT "IN THE THIRTIES" ELSE
   PRINT "TOO B␣G"
20 GOTO 10
```

Figure 2

```
10 INPUT "␣INPUT A";A
20 IF A<20
      THEN
           PRINT"LESS THAN 20":
      ELSE
   IF A<30
      THEN
          PRINT "LESS THAN 30":
      ELSE
   IF A<40
      THEN
          PRINT "IN THE THIRTIES":
      ELSE
           PRINT "TOO BIG"
30 GOTO 10
```

Figure 3

a)
```
80 IF N>0 AND A/N>10 THEN A$="HI" ELSE A$="LO" ELSE
A$="<=0"
90 RETURN
```

b)
```
80 IF N>0 THEN
   IF A/N>10 THEN A$="HI" ELSE A$="LO"
   ELSE A$="<=0"
90 RETURN
```

c)
```
80 IF N<=0 THEN A$="<=0" ELSE
   IF A/N>10 THEN A$="HI" ELSE A$="LO"
90 RETURN
```

Figure 4

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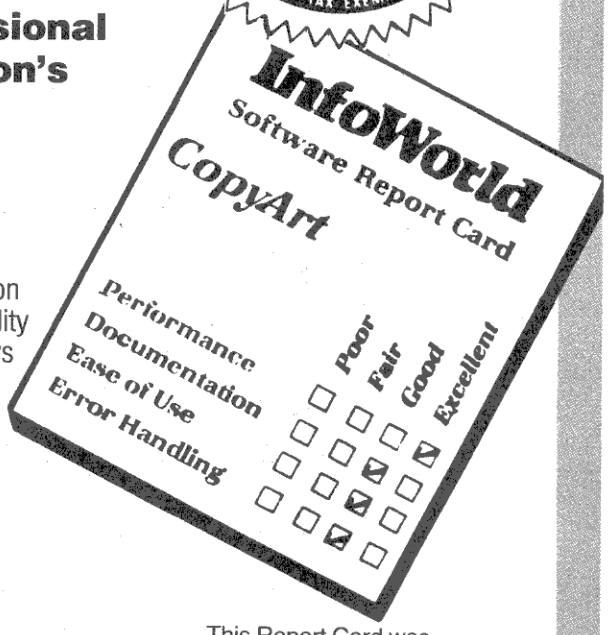

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ecutes in-line code faster than called subroutines. Maximum speed is obtained by duplicating commonly used routines where necessary in the program. The trade-off for increased speed is increased program length.

If you choose to call a common subroutine throughout a program, GOTO is a much faster call than GOSUB. Otherwise, GOSUB is more convenient and easier to use. GOSUBs require no consistency within a program.

In-line code makes sense within the body of a keyboard polling routine. GOTO makes sense to call that routine and perhaps a graphics plot routine where operator interaction is critical. GOSUB is fine when there are hardware or human speed limitations and there is no other alternative.

Try your best to have one entrance to and one exit from a routine. Multiple exits can make tracing program flow a real nightmare. Figure 5 (a) shows GOTO used to point to multiple exits. Figure 5 (b) leaves 100–120 as independent subroutines but uses line 90 to ensure a single return point for line 80.

The On command is a natural when parsing the reply to a menu query. Figure 6 (a) illustrates the requirements. The On statement compares the value of a variable with a series of GOTO or GOSUB line numbers. If the variable value is less than one, an error occurs. Error checks should be made early in the program. If the variable value is larger than the number of subroutines in the On statement, the program goes on to the next statement. Either check for impossibly high values or provide an escape route similar to that illustrated in Fig. 6 (b).

There is little difference in execution time between the two techniques. Figure 6 (b) is, perhaps, a more general solution. Note the jump back to line 200 in the case of an impossible choice. Blinking the screen before asking for a retry tells the operator that the computer read the entry but did not accept it. Always try to get some immediate visual confirmation that the computer accepted input data.

I mentioned earlier that some special rules apply when the interpreter performs mathematical calculations. The rules are straightforward and clearly described in the manuals. Unfortunately, Radio Shack provides few illustrations. Figure 7 illustrates some common arithmetic problems and shows the end results as a remark after each statement.

a)

```
80  IF A<=0 THEN 100 ELSE
    IF A/10<10 THEN 110 ELSE 120
100 A$="<=0": RETURN
110 A$="LO": RETURN
120 A$="HI": RETURN
```

b)

```
80  IF A<=0 GOSUB 100 ELSE
    IF A/10<10 GOSUB 110 ELSE GOSUB 120
90  RETURN
100 A$="<=0": RETURN
110 A$="LO": RETURN
120 A$="HI": RETURN
```

Figure 5

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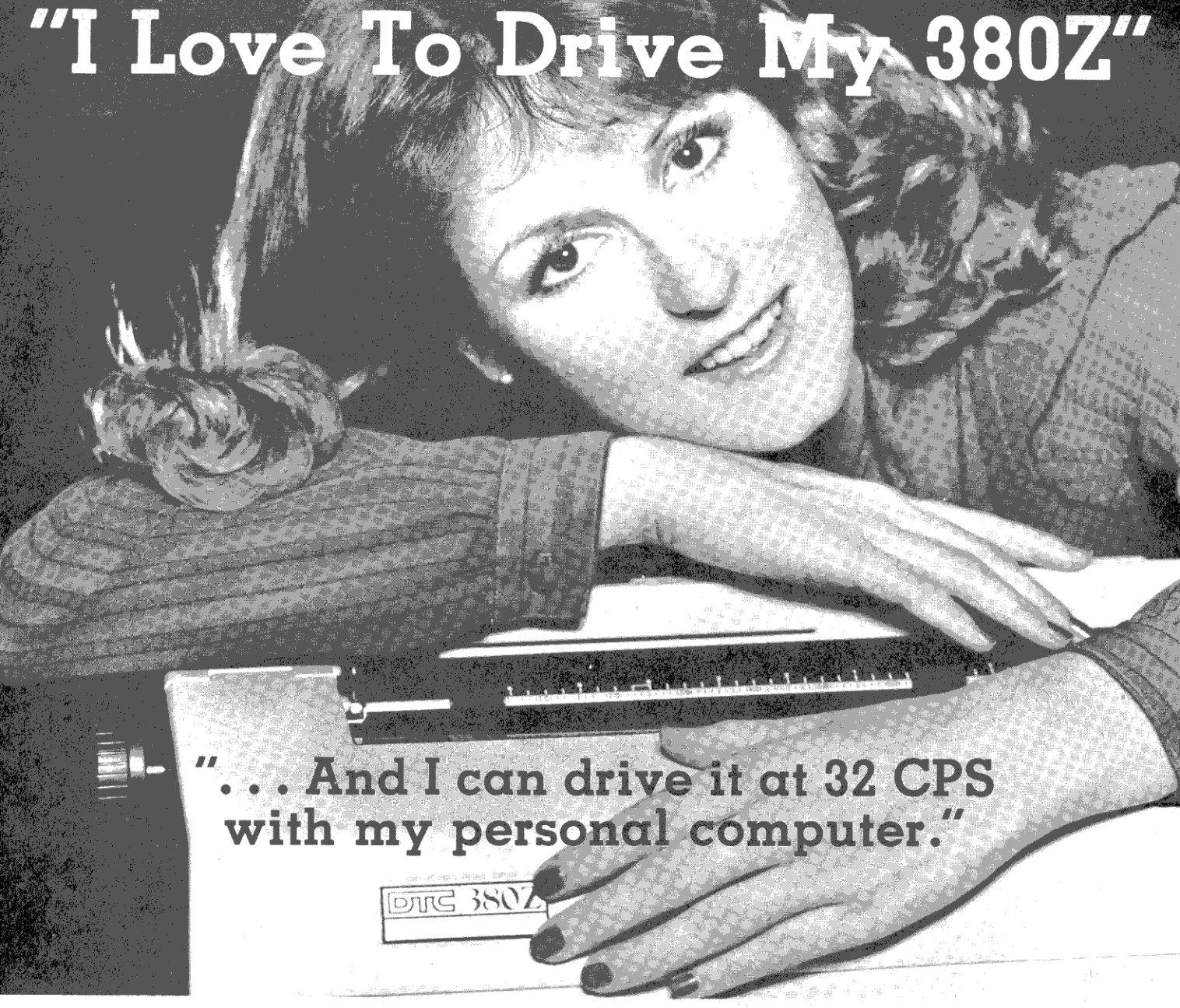

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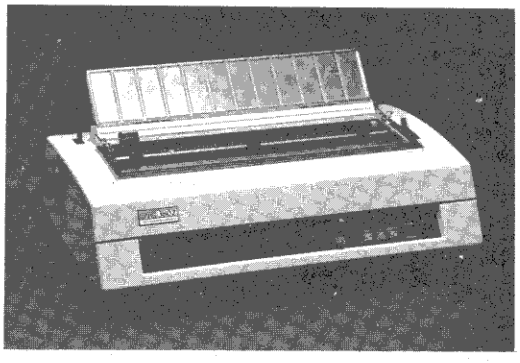

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The ^ character is used for exponentiation as it is in the Model III. Model I owners use an up arrow or a square left bracket.

Line 300 establishes values for a number of variables. Line 310 illustrates normal left-to-right evaluation of the operators. Line 320 indicates the precedence of exponentiation over division and division over addition. Line 330 illustrates the precedence of negation over division. Lines 340 and 350 illustrate the difference between multiplication and exponentiation. Multiplication of two negative numbers always results in a positive number. Signs do not change in exponentiation.

Line 360 might help those who are not familiar with radians or MicroSoft's trigonometry functions. Radians are units of angular measure employed by scientists and artillery officers. The rest of us are much happier with degrees. We think a circle is made up of exactly 360 degrees and consider that complicated enough. For some reason, others insist that a circle consists of exactly 6.2831853 + radians. This number is exactly two times pi, a most frustrating number. The letters D, E, F, and G are the radian equivalents of 90, 180, 270, and 360 degrees. If you have degrees and want plain answers, multiply the degrees by 6.2831853/360 (.017453) before using them in trigonometric functions.

That does it for this month. I've mentioned some of MBasic's structure, the way program flow can be controlled, and some math oddities. Next month I'll look at program loops to see how they can run smoothly. ■

John Corbani can be reached at 2455 Calle Linares, Santa Barbara, CA 93109.

a)

```
200 CLS: PRINT TAB(10)
    "(1) READ": PRINT TAB(10)
    "(2) WRITE": PRINT TAB(10);
210 I$=INKEY$: IF I$<"1"OR I$>"2" THEN 200 ELSE
    I=ASC(I$): ON I GOSUB 400, 500: GOTO 200
```

b)

```
210 I$=INKEY$: IF I$>"0" THEN
    I=ASC(I$): ON I GOSUB 400, 500
220 GOTO 200
```

Figure 6

```
300 A=10: B=20: C=30: D=1.5708: E=3.1416 F=4.7124: G=6.2832
310 PRINT A/B*2          'A/B=.5: .5*2=1
320 PRINT C+B/A^2          'A^2-100: B/100=.2: C+.2=30.2
330 PRINT B/-A*-A        '-A=-10: B/-A=-2: -2*-A=20
340 PRINT -A*-A          '=+100
350 PRINT -A^2           '=-100
360 PRINT SIN(D), SIN(E), SIN(F), SIN(G)
                         '=1, =0, =-1, =0
```

Figure 7

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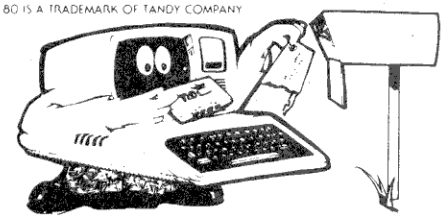

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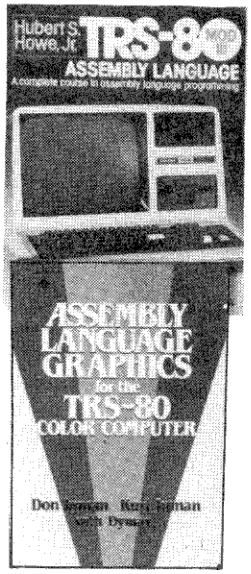

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Mod II CRT Controller

by Steven and Yvonne Grant

The Model II contains a number of hardware/software capabilities that are not exploited by Radio Shack's TRSDOS. SDLC/HDLC communications hardware, direct memory transfers and compares, 16K video memory scrolling, light-pen controls, and a host of other facilities exist, but are not implemented in the Model II.

Program the Model II's MC6845 chip so you can control up to 16 of its screen functions.

In the meantime, users can experiment with these capabilities. The two programs shown here allow users to program the Motorola MC6845 CRT controller chip, which defines the Model II's screen.

The Basic routine in Listing 1 provides a menu-driven program allowing 16 of the screen functions controlled by the MC6845 to be changed individually or several at a time. Basic should be started with the −M:61400 command to protect the machine-language routine.

The Assembly-language routine in Listing 2 picks up the modifications requested by the Basic program and feeds them to the internal registers of the MC6845.

We don't own an assembler, so the op-codes required for the machine code were typed in using Debug and then saved as an executable file with the Dump command from TRSDOS. The completed section of memory should look like Fig. 1. The Dump command format is DUMP CRT7 {START = EFE0 END = EFF7 TRA = EFF7}. This will save the machine code and execute it starting with the C9 op-code at EFF7. This starting point allows Basic to load the program and then take up at line 40 immediately

Program Listing 1

```
10      'CRTC SCRAMBLER
20      'THIS PROGRAM ACCESSES A MACHINE LANGUAGE PROGRAM AT EFE0 hex
22      'TO MODIFY THE TRS-80 MODEL II CRTC CONTROLLER
30      SYSTEM "CRT7"           'THIS LOADS THE MACHINE LANGUAGE ROUTINE
40      DEFUSR1 = &HEFE0
50      RV$ = CHR$(26)          'RV$ = SETS THE REVERSE VIDEO MODE
60      NV$ = CHR$(25)          'NV$ = SETS THE NORMAL VIDEO MODE
70      DIM V(16)               'CONTAINS THE VIDEO VALUES
80      FOR J = 1 TO 16
90      READ T:V(J)=T           'FILL THE VIDEO ARRAY
100     NEXT J
110 DATA 56.75, 52, 53, 17, 19.125, 16, 19, 19, 16, 17.125, 57, 17.125, 16, 16, 16, 16
120     CLS
130     PRINT @100," TRS-80 MC6845 CRTC MODIFICATION MENU "
140     PRINT @260,RV$;" 1 ";NV$," HORIZONTAL FREQUENCY "
150     PRINT @340,RV$;" 2 ";NV$," HORIZONTAL CHARACTERS PER LINE "
160     PRINT @420,RV$;" 3 ";NV$," HORIZONTAL SYNC POSITION "
170     PRINT @500,RV$;" 4 ";NV$," HORIZONTAL SYNC WIDTH "
180     PRINT @580,RV$;" 5 ";NV$," VERTICAL FREQUENCY "
190     PRINT @660,RV$;" 6 ";NV$," VERTICAL CHARACTERS "
200     PRINT @740,RV$;" 7 ";NV$," VERTICAL DISPLAYED ROWS "
210     PRINT @820,RV$;" 8 ";NV$," VERTICAL SYNC POSITION "
220     PRINT @900,RV$;" 9 ";NV$," INTERLACE MODE "
230     PRINT @980,RV$;"10 ";NV$," MAXIMUM SCAN LINES "
240     PRINT @1060,RV$;"11 ";NV$," CURSOR FORMAT "
250     PRINT @1140,RV$;"12 ";NV$," CURSOR END SCAN LINE "
260     PRINT @1220,RV$;"13 ";NV$," HIGH ORDER START ADDRESS "
270     PRINT @1300,RV$;"14 ";NV$," LOW ORDER START ADDRESS "
280     PRINT @1380,RV$;"15 ";NV$," HIGH ORDER CURSOR POSITION "
290     PRINT @1460,RV$;"16 ";NV$," LOW ORDER CURSOR POSITION "
300     PRINT @1540,RV$;"17 ";NV$," IMPLEMENT THE MODIFICATIONS "
310     PRINT @1620,RV$;"18 ";NV$," SET EVERYTHING NORMAL "
320     PRINT:PRINT TAB(5);
330     INPUT "ENTER THE NUMBER FOR THE FUNCTION DESIRED ";A
340     CLS
350     IF A = 18 THEN RESTORE:FOR J = 1 TO 16:READ T:V(J)=T:NEXT J:GOSUB 430:GOTO 120
360     IF A = 17 THEN GOSUB 430:GOTO 120
370     PRINT @500,"THE CURRENT VALUE IS ";V(A)
380     PRINT @660,"ENTER THE NEW VALUE ";
390     INPUT AA
400     V(A) = AA
410     GOTO 130
420     END
```

Listing continues

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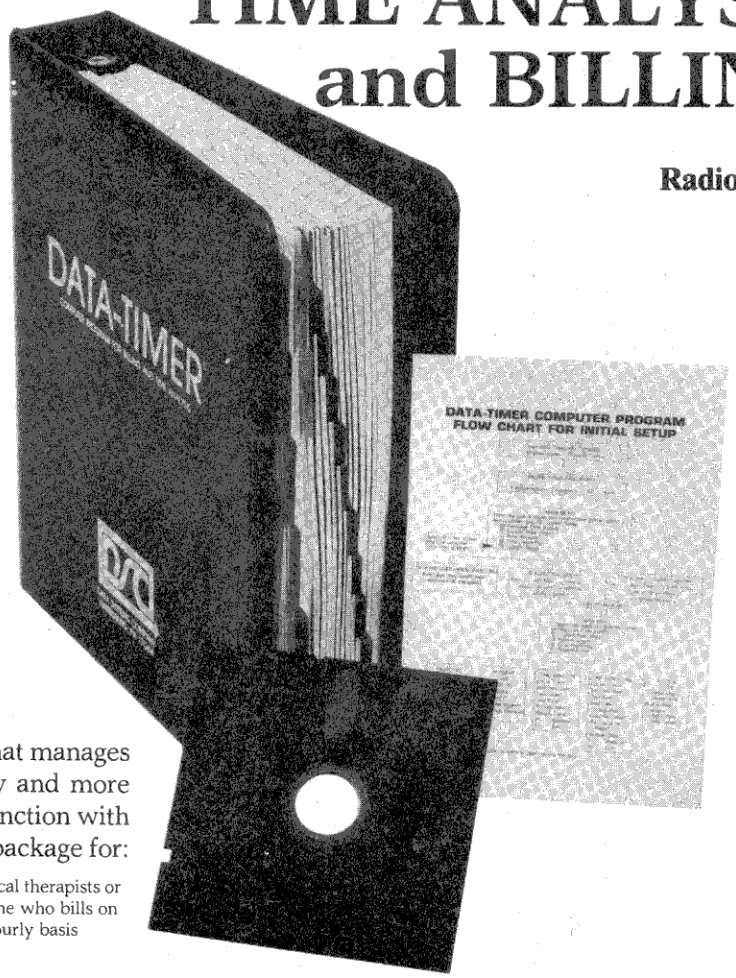

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Listing continued

```
430     X = USR1(VARPTR(V(1)))
440     FOR XX = 1 TO 22
450     FOR YY = 1 TO 75 STEP 5
460     PRINT @(XX,YY),"*"
470     NEXT YY
480     NEXT XX
490     PRINT @0,"ENTER 'N' FOR A NEW RUN";:INPUT RS:CLS
500     RETURN
```

```
TRS-80 Model II DEBUG Program
EF80    00 00 00 00 00 00 00 00   00 00 00 00 00 00 00 00   ................
EF90    00 00 00 00 00 00 00 00   00 00 00 00 00 00 00 00   ................
EFA0    00 00 00 00 00 00 00 00   00 00 00 00 00 00 00 00   ................
EFB0    00 00 00 00 00 00 00 00   00 00 00 00 00 00 00 00   ................
EFC0    00 00 00 00 00 00 00 00   00 00 00 00 00 00 00 00   ................
EFD0    00 00 00 00 00 00 00 00   00 00 00 00 00 00 00 00   ................
EFE0    22 EA EF 11 03 00 01 FD   10 2A 0C 2E 2B 3E FF 3C   ".........*..+>.<
EFF0    19 D3 FC ED A3 20 F7 C9   00 00 00 00 00 00 00 00   ..... ..........
  PC    SP  SZHPNC  AF   BC   DE   HL   IX   IY   AF'  BC'  DE'  HL'
 2800  21FE  000000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
? P
```

Figure 1

after the command in line 30 sticks CRT7 in memory.

The Basic program loads the machine code and then sets up a USR call in line 40. This statement provides a link between Basic and the machine code at EFE0. The machine code duplicates the function of the TRSDOS CRT subroutine at 0664. TRSDOS still has its screen initializer resident in low memory so that a Basic CLS command will reinitialize the screen from 0664 in TRSDOS and bypass the user's experiments.

The main body of the program, from line 130–400, provides the menu of items that can be changed and then fills an array with any new values entered by the user.

There are a lot of different ways to enter hex data directly from a Basic program. We've chosen low-value decimal fractions and integers that are represented in machine code by the hex numbers desired. Because of the way Basic represents, for instance, single-precision numbers, entering decimal 18.375 causes a hex 13 to be stored in the array. Decimal 16 is represented by hex 00. Changes should be made in .125 increments in the Basic program in order to change the MC6845 values by one unit.

Line 430 issues the call to the machine-code routine by using VARPTR. VARPTR identifies the memory address that points at the array containing the data entered by the user. The end of the program just displays a few asterisks on the screen so that users can see the results of any changes.

The machine code explained in Listing 2 locates the first variable in the ar-

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ray containing the CRT definition data and successively reads each byte, passes it into the appropriate register of the MC6845, locates the next variable, passes it along, and so forth. The Model II uses port FC to specify which register of the MC6845 is being addressed and then stuffs the data values into that register through port FD. Once all 16 registers have been loaded, control passes back to the Basic program.

We won't go into a lengthy explanation of each register's function in the MC6845. Most of the functions are self-explanatory after a little experimentation. Exhaustive detail is provided in either the *TRS-80 Technical Reference Manual* or in the *MC6845 CRTC Data Sheet AD1-465* published by Motorola. Anyone sending us an SASE will receive a detailed description of the device.

Altering some of the parameters controlled by the MC6845 causes drastic changes in the CRT display. It is hard to imagine practical applications for a nonstandard horizontal sync width, for instance, but it may be possible to incorporate the stranger patterns into games or graphics. A user could even add video memory and build dramatic high-speed graphics on the Model II using modified versions of the programs described here. ■

MC6845 CRTC MODIFICATION CODE

Op-Codes	*Instructions*	*Explanation*
22 EAEF	LD EFEA, HL	Load the value of HL which is provided by the Basic VARPTR command.
11 0300	LD DE, 00 03	Load the value used to increment HL.
01 FD10	LD BC, 10 FD	Load B with the loop count. Load C with the CRTC register port.
2A nnnn	LD HL,(nnnn)	Load HL with the address of first variable in the Basic array. This value is loaded indirectly from the first line.
2B	DECREMENT HL	
3E FF	LD A, FF	Load A for increment.
3C	INCREMENT A	Set A to register 0.
19	ADD HL, DE	Increment HL.
D3 FC	OUT (FC), A	Condition register addressed by port FC to accept input.
ED A3	OUTI	Send value pointed to by HL into register addressed by A. Then increment HL and decrement B.
20 F7	JR, NZ 8	Jump back if B is not zero.
C9	RETURN	

Program Listing 2

Steven and Yvonne work in telecommunications. They can be reached at 366 N. 117th Court, Apt. 9, Omaha, NE 68154.

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Eigen Systems	Basic Aid	$49.95	4K	C		Y	Y
Data-Comp	Text Editor	$50	64K	D	FLEX	Y	Y
Frank Hogg Laboratory	"Ed" Editor	$50		D	FLEX	Y	Y
		$125		D	OS-9	Y	Y
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Utilities are necessary tools for every serious programmer. These programs are standard routines that help users operate computers. They can recover blown disks or repair those damaged by power surges, ease the coding process, and increase program versatility.

There are many categories of utilities. Each has its own characteristics and options. Having the right utilities available when you need them makes all your programming tasks run smoothly.

This guide presents the different utilities made especially for the Color Computer. Special features and options are mentioned, as well, to help you make an informed decision.

Editors

Text editors enter and manipulate text files from the keyboard. They work like simple word processors to insert, change, or delete file items.

Screen editors permit cursor movement across the video screen without destroying any of the text it passes over. Graphics characters, and other characters not normally accessible from the keyboard, can be entered directly.

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As you can imagine, disassemblers

Y indicates that capability

S = Screen
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Y	Y	N	Global and local	Can edit or create files larger than memory.
N			N	
	Y	Y	Y	
Y	Y	Y	Y	
Y	Y	Y	Y	
Y	Y	Y	Y	
Y	Y	Y	Y	Reconstructs files.

Documentation Provided	Supports Macros	Conditional Assembly	Renumberer	Search and Replace	Load Radio Shack Source Code	Description
Y	N	N	Y	Y	Y	
Y	N	N	Y	Y	Y	
Y	N		Y	Y	Y	Debug monitor included.
Y	Y	Y	Y	Y	N	
Y	N	N	N	N	N	Includes machine-language monitor. Sends object code to RAM.
Y	N	Y	N	Y		
Y	Y	Y	N	Y	Y	

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The Micro Works Inc.	80C Disassembler	$49.95	16K	C	Y	Y	Y	S, P	Y

ASSEMBLERS

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		$39.95	4K	ROM Pack	Y	N	Y	N
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Color Software Services	Disk Zonker	$24.95	16K	D		Y	Y
Ilume Design	Diskpro	$29.95	32K	D		Y	Y
Nelson Software Systems	Super "Color" Disk-Zap	$49.95	16K	D		Y	Y
Superior Graphic Software Products	The Directory Doctor	$49.95	16K	D	Radio Shack TRS-80-C	Y	Y
	The Disk Doctor	$49.95	16K	D		Y	Y
	The Disk Hospital	$99.95	16K	D		Y	N

perform the opposite of assemblers; they translate from machine language to assembly language. They decipher machine-language programs by generating symbolic-code listings.

Monitors

Monitors provide the interface between a machine-code program and the programmer. Since machine-code programs execute directly on the microprocessor chip, evolving programs must be protected against system crashes.

Monitors let you insert breakpoints within the code. When a breakpoint is encountered, the monitor regains control from the program being debugged. This gives you a chance to check the status of registers in the microprocessor or bytes in RAM to check whether the

	Documentation Provided	Support Macros	Conditional Assembly	Machine-Language Monitor Included	Send Object Code to RAM	Description
	Y	N	N	N	Y—Tape or Disk	Cross-assembles 6800-6809 code.
	Y	Y	Y	Y	Y	
	Y	Y	Y	N	N—to disk	

	Relocatable	Set Breakpoints in RAM	Set Breakpoints in ROM	Description
	Y	up to 10	N	
	Y	Y	N	Also comes with small assembler.
	Y	N	N	
	Y	N	N	
	Y	Y	N	

Y indicates that capability

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	Modify by File	Modify by Sector	Description
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	N	Y	
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	Y	Y	
	N	Y	Checks, recovers, and stores allocation tables and spare directory track.
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A. M. Hearn Software	TAPEXFER	$ 9.95	16K	C	Y	Loads tape programs to disk automatically. Displays each program as it copies.
	OFFLOAD	$ 9.95	16K	C	Y	Creates tape backups of disks. Tape⇄disk.
CoCo Pro	CoCo Copy	$15	32K	D	Y	Copies tape⇄disk, disk→disk, allows disk kill.
Color Software Services	Disk Backup	$16.95	16K	C, D	Y	Loads disk to tape.
Double Density Software	Color Disk Saver	$12.95	32K	C	Y	Disk→tape and reloads tape to disk to restore a blown disk.
	Auto Load	$12.95	16K	C	Y	Leads tape→disk.
DSL Computer Products	Copy Cat	$19.95	16K	C	Y	Lets user back up software.
Ilume Design	DTT	$14.95 (C) $19.95 (D)		C, D	Y	Copies program disk→tape (up to nine times).
	TTD	$14.95 (C) $19.95 (D)		C, D	Y	Transfers tape programs to disk automatically, individually or complete tape (up to nine copies of each program).

program is functioning as it should. The monitor lets the target program resume, ensuring that all registers are in the state they held at the time of the breakpoint.

All monitors permit displays or printouts in various formats including decimal, octal, hexadecimal, ASCII, or symbolic (where symbols are displayed instead of values). These symbols are the mnemonics referred to in disassemblers. Some monitors even offer a disassembler as an option. Data displayed or printed can be altered from the monitor and might affect the results of any resumed execution of the main program.

Another option, single-stepped code, lets you execute one opcode at a time. This is not a hardware option due to chip architecture.

A sort option saves you from rewriting your own sort routine every time you need to rearrange data in a program.

Disk Zappers

Disk zappers are among the most useful utilities. They often save disks that for some reason have been blown. Dust, hair, and smoke particles can collect on disks and interfere with writing.

The disk zapper finds the bad sector and lets you write over it with fake information. This enables the program to load, and you can rewrite over the false data. It's much easier than rewriting the entire program.

Many zappers find and restore killed files by altering a single bit on the disk utility and restoring that file's entry in the directory hash index table (HIT). Since many operating systems kill only

FILE UTILITIES

Company Name	Product Name	Price	Minimum RAM	Cassette (C) or Disk (D)	DOS(es) Required
A. M. Hearn Software	Catalog	$ 9.95	16K	C	
	Tapedir	$ 9.95	4K	C	
	Neatdir	$ 6.95	16K	C	
CoCo Pro	Master Directory	$20	32K	D	
	EXPDIR	$12	16K	D	
	COLORDIR	$12	16K	D	
Custom Software Engineering Inc.	Disk Data Handler	$54.95	32K	D	
Data-Comp	SORT/MERGE	$75	64K	D	FLEX

TAPE UTILITIES

Company Name	Product Name	Price	Minimum RAM	Cassette (C) or Disk (D)	Documentation Provided	Description
A. M. Hearn Software	COPYTAPE	$9.95	4K	C	Y	Copies and merges tape-based software.
B. Erickson Software	Cassette Dump	$10	16K	C	Y	Prints out non-protected tapes.
	Cassette Copy	$10	4K	C	Y	Cassette copy program.

COMPRESSORS/RENUMBERERS

Company Name	Product Name	Price	Minimum RAM	Cassette (C) or Disk (D)	Documentation Provided	Remove Blanks and Remarks	Produce Multi-line Statements	Unpack
Eigen Systems	Stripper	$ 7.95	4K	C	Y	Y	Y	N

the directory entry leaving the file itself intact until it is overwritten, only that entry must be amended. Some disk zappers even let you completely restore old files.

Compressors/Renumberers

Compressors remove blanks from programs so that they are compiled more quickly and reduce processing time.

Renumberers are the last utility needed in program development. They renumber lines, perhaps enlarging the increments between lines, to facilitate future installation of new features.

File Utilities

Some file utilities read and write files between formats, copying individual files between the disks, or merging several files into one.

With other utilities you can examine and manipulate the contents of a file. These utilities usually give detailed information, such as an expanded menu or catalog of the disk's contents.

Some also imitate the editing features of a DBMS (data-base management system), and let you sort, add or remove fields. ■

Buyer's Guide continues

Documentation Provided	Description
Y	Creates a file of disk directories and lets programs be run without knowing which disk contains them. Printer option.
Y	Creates a directory of your tapes.
Y	Alphabetizes disk directories.
Y	Combined directory of all disks.
Y	Saves up to 120 files on a disk.
Y	Provides sorted directory list with lengths address, grans used. Optional report to printer.
Y	Lets you define disk data files, input, update and report user data. Printer option.
Y	Quickly sorts and merges files, including those too large for memory.

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GENERAL UTILITIES

Company Name	Product Name	Price	Minimum RAM	Cassette (C) or Disk (D)
A. M. Hearn Software	BACKUP	$ 9.95	16K	C
	CCRPM	$12.95	16K	C
	ONERR	$12.95	4K	C
	TAPELIB	$12.95	4K	C
B. Erickson Software	ROM-Save	$10	4K	C
Cer-Comp	Hi-Resolution Text Screen Display	$24.95	16K	C, D
Computer Shack	Color DFT	$24.95 (C) $29.95 (D)	16K	C, D
Custom Software Engineering Inc.	Alpha-Draw	$ 8.95	16K	C, D
	Graphic Screen Print Program	$ 7.95 for Radio Shack printers $ 9.95 for non-RS	16K	C, D
	Basic Precompiler	$50	64K	D
	F-Mate FLEX Utilities	$75	64K	D
	FLEX F-Mate	$69.95	64K	D
	F-Mate FLEX Diagnostics	$75	64K	D
	Four Drives From Two	$19.95	32K	C
	Terminal-CoCo	$19.95	64K	D
Double Density Software	Color Key Command	$18.95	16K	C
	DD Clock	$ 9.95	4K	C
	Tape Name	$ 7.95	4K	C, D
Eigen Systems	Disk Basic Aid	$49.95	32K	D
Frank Hogg Laboratory	FHL Extended Use Utilities	$49.95 object $69.95 source		D
	FHL Color Utilities	$50 object $75 source		D
Ilume Design	Screen Print Program	$14.95 (C) $19.95 (D)		C, D
Spectrum Projects	64K Disk Utility Package	$21.95	64K	D
	Electronics Drafting Board	$39.95	64K	D
Star-Kits	Nowtalk	$20	16K	C, D
	STAR-DOS	$49.90	16K	D
	STAR-DOS 64	$75	64K	D
Sugar Software	Auto Run	$14.95	16K	C
	Piratector	$99.95	32K	D

Y indicates that capability

S = Screen
P = Printer
C = Cassette
D = Disk

Documentation Provided	DOS(es) Required	Description
	Y	Helps recover crashed disks, hastens backups.
	Y	Disk drive speed-checking routine. Displays on screen current, average, high, and low speeds of your drive. Comes with instructions to correct speed.
	Y	Error handler for Basic programs. Lets your program take control in the event of errors.
	Y	Library of five subroutines with an append routine.
	Y	Utility to copy ROM packs to cassette.
	Y	Allows use of 32-by-24, 42-by-24, 51-by-24, and 64-by-24 text screens with Basic and other programs. Lets you mix text and graphic supports.
	Y	Direct file transfer of Basic programs from Models I or III to the Color Computer.
Extended Color Basic	Y	Subroutine that draws any keyboard character on the graphics screen.
Extended Color Basic	Y	Produces printout of screen image produced by program in machine language.
FLEX	Y	Lets you use free format, unlimited variable lengths. Basic is automatically compiled so it can't be listed.
FLEX	Y	Package of 15 different utilities.
FLEX	Y	Part of package to install FLEX.
FLEX	Y	Zeroes and 1's test of memory diagnostics, random pattern test, walking bit tests, dynamic drop-out tests, and convergence test. Also has disk-repair section.
	Y	Lets user specify each side of a double-sided drive as an individual drive.
FLEX	Y	Lets you use standard CRT with Color Computer.
	Y	One-button entry of over 80 Basic commands.
	Y	Real-time clock displays on screen at all times.
	Y	Saves the name of each program found on a tape to printer or tape.
	Y	Speeds and simplifies writing and entering Basic programs.
FLEX	Y	Includes many utilities.
FLEX	Y	Includes many utilities.
	Y	Dumps high-resolution graphics screens to printer.
	Y	Program makes additional 8K RAM available, also includes a spooler and ROM pack to disk converter.
	Y	Creates electronic circuits on a 480-by-540-pixel worksheet.
		Machine-code dump program that outputs hex code in a human voice through television speaker.
Star-DOS	Y	Disk operating systems compatible with Radio Shack disk format.
	Y	
	Y	Auto program loader with Color Graphics editor to create title screens.
	Y	Piracy protection for Color Computer disk systems.

Logo for the CoCo

by Molly Watt

You can introduce your children to programming on the Color Computer with Radio Shack's new Color Logo. It'll give them a good start.

★★★★

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$49.95 program pack, 16K RAM

A good introduction to an analysis of Color Logo is a review of the creation and purpose of the original Logo. Both languages have similar educational goals and applications, although their capabilities are somewhat different.

Logo was developed at MIT (Massachusetts Institute of Technology) with funding from The National Science Foundation. It took more than a decade of research and development before its release.

Logo is a sophisticated programming language capable of complex data processing, handling many variables, using embedded recursion, and accepting user input. It is structured, so programs are composed of procedures as parts of a superprocedure.

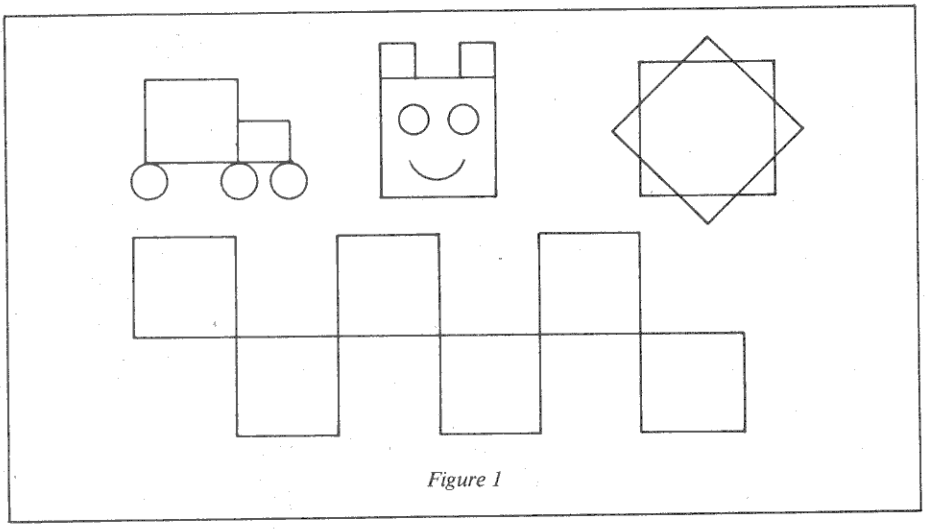

Figure 1

Seymore Papert, Logo's most prominent spokesperson, worked with Jean Piaget prior to his work on Logo. He developed the language based on the knowledge that children learn through playful exploration.

Logo provides an artificial intelligence environment in which the user learns about geometry and computer programming simultaneously by solving problems like those Jenny and Joey encountered (see sidebar).

This mirrors Piaget's thesis that all true learning involves interaction and forming a theory about how to do some task—in this case drawing a square—and then revising the theory when it proves inadequate.

The MIT Logo Group designed this language with "no threshold, no ceiling." Logo would be an appropriate and almost natural language for a young child to use and continue using in an extremely complex fashion as an adult.

At this point, a full Logo language barely squeezes into the memory of 64K computers. Many users find that they quickly deplete the amount of user-available memory.

Color Logo

George Gerholt and Larry Kheriaty developed Color Logo for the TRS-80 Color Computer. As they point out in their manual, "Color Logo is not just Logo under another name for another computer; there are some very important differences between the two."

The authors retain the Piagetian philosophy of Logo by informing users that it is a language with which a child

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Our popular smart terminal program has just gotten a lot smarter. After two years of experience with TELCOM and many requests from customers, we have created TELCOM II for the most demanding telecommunications applications. **TELCOM II** maintains the same ease of operation and all the features of our original program (see below), and includes many enhancements. The terminal mode now has a help menu, a large spooler for simultaneous printer output at high baud rates, acknowledges receipt of all commands, and displays control characters. You can now load disk files into the memory buffer from within the terminal mode, transmit the buffer with a single command, and send files a line at a time. You can even view the buffer or data that has already scrolled off the screen. **TELCOM II** has 10 different 40 character programmable messages that can each be sent with a single command, and the messages can now include control codes and delays. It also has 5 different character translation tables for compatibility with different systems. One of the most substantial additions to TELCOM is a full protocol file transfer mode which is compatible with the LYNC program available on CP/M systems and the IBM PC. **TELCOM II** will exchange disk files with any computer running this protocol (including another TRS-80 running TELCOM II), and will automatically correct errors in transmission! Files can be sent to or fetched from an unattended computer with ZERO errors. The extreme ease of use TELCOM is known for has not been compromised. Reconfiguration of the programmable features is done internally from clear menus for fast, easy operation. **TELCOM II** comes with a comprehensive instruction manual which is available separately for $5 (which will apply to subsequent purchase of the program). You won't find a smarter or easier to use terminal program at any price.

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learns and explores. It incorporates some powerful ideas in math, computer science, and problem-solving.

However, because the full Logo language does not fit in the CoCo's memory, Color Logo mimics only the turtle graphics capabilities of Logo. The list processing capabilities of Logo, seldom used by school children but often used by their teachers, are not present.

Color Logo has three modes. Run is the direct interactive mode in which you communicate with the turtle and watch what happens on the screen (see sidebar). Most user experimentation while learning the language takes place in the Run mode.

Doodle is a drawing mode for very young users. You draw by typing commands with single keystrokes, similar to the programs called "Instant" that appear in books on Logo.

Edit is the mode where you define and revise procedures. In Edit, you have more flexibility in commands and syntax than you have in Run.

Another feature of Color Logo is its multiple turtles. In fact, there are more than 250 of them, and they can each draw at different points of the screen—very slowly.

The ability to change the shape of the turtle provides some nice possibilities for animation projects. The program also responds to one-keystroke input. These features provide some basic tools for creating simple interactive games.

A Critical Look at Color Logo

I was able to use Color Logo immediately based on my knowledge of other Logo implementations. Many of the commands are the same.

The 135-page documentation is clearly written and illustrated. It is well organized and complete. Almost any adult could easily learn Color Logo using this manual, although new documentation or charts are necessary for young users.

You can learn Logo at the computer, so my initial experiments occurred in the Run mode. First, I moved the turtle forward 30, then 40, and later 100.

To my amazement, I found that when the turtle wraps around from the top of the monitor to the bottom, it does not draw a line. Lines only appear when the total command can execute on the monitor screen. This is inconsistent with other versions of Logo and interferes with a child's understanding of the computer's capabilities.

Next, I typed FD twice on the same line, resulting in the command FD FD 50. Then an extra turtle hatched on the screen and I couldn't get rid of it. Color

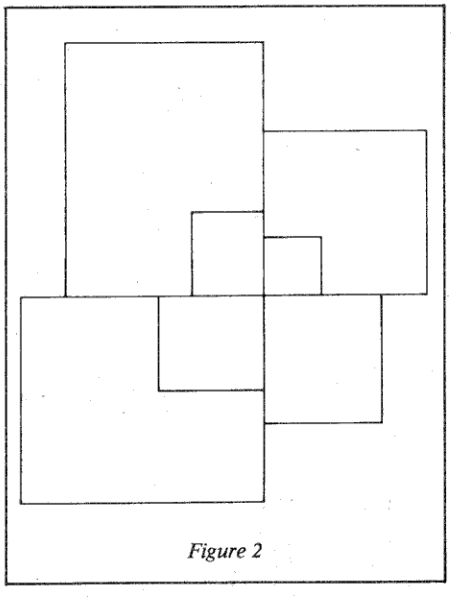

Figure 2

The Logo Learning Process

Imagine Jenny and Joey, two second-graders about to use Logo on a computer for the first time. Their teacher has challenged them "See if you can draw a square with the computer."

To do this, they'll have to type instructions on the keyboard to direct a tiny surfboard-shaped "turtle." The turtle already knows how to perform several functions, called primitives. Their teacher gives Jenny and Joey four primitives to work with: Forward, Back, Right, Left.

Joey decides to pretend that he is the turtle. He walks the steps the turtle would to form a square. Jenny sits down on the rug to record the action.

As Joey walks, he describes what he is doing out loud: "I'm walking forward six steps. Now I'm turning right. Now forward six again. Now I'm turning right. Now forward six again. Right, forward, and that's it. I'm done!"

Jenny has written on her paper:

How to make a square
forward 6
right
forward 6
right
forward 6
right
forward 6

Together they approach the computer and start typing.

Forward 6 ("Oh, Oh, not far enough. Now what? Try 30.")
Forward 30 ("OK, that's better.")
Right
The computer prints an error message: RIGHT NEEDS MORE INPUTS.
("Inputs—what's that? How much should I turn? Oh, I don't know, try 30. No, more; 60. No, more—90. OK, that's good. Next.")
Forward ("I forget how much. Six was too small. . .")

Using a range of problem-solving strategies, including trial and error, asking for help, discussing and describing the problem, and estimating, they evolve the following steps for drawing a square:

FORWARD 36
RIGHT 90
FORWARD 36
RIGHT 90
FORWARD 36
RIGHT 90
FORWARD 36

Now that they have solved the problem, Jenny and Joey are ready to teach the computer a procedure for drawing a square. This procedure

Logo does not accept more than one command per line in Run mode.

I also attempted to reproduce a favorite activity of elementary students by typing REPEAT 100 (FD 88 RT 33 FD 42 RT 11 BK 3 LT 10 FD 50. . .). Nothing happened. An error message informed me: "I CANT DO THAT IN THIS MODE."

Another favorite challenge to beginning Logo users is teaching the turtle to draw a circle. Even adults find this a mystifying experience, since they usually think about circles in terms of geometry formulas. In Logo, many different sets of instructions create a circle shape.

In Color Logo, the turtle represents only turns of 45 degrees. A command less than 45 turns the turtle zero if the number is nearer zero than 45, and rotates 45 if it is closer to 45 in value.

The two examples in Figs. 3 and 4 look identical on the monitor in other versions of Logo. There is no logical reason for them to look different from each other in this version, yet they do.

Most young children draw a circle in the most literal way first, taking 360 turtle steps and turns, but it won't work in Color Logo. This is another illustration of the inability to use repeat in the Run mode.

A fundamental concept in turtle geometry, the Total Turtle Trip Theorem, states that all closed geometric shapes must turn the turtle 360 degrees. This basis for exploration, geometric thinking, and pattern-building in a Logo curriculum is less flexible in Color Logo.

An enjoyable feature unique to Color Logo is the Hatch command that creates new turtles. The documentation includes an entire chapter on this function and I enjoyed duplicating some of its procedures.

The Tree program in Program Listing 1 demonstrates using a group of turtles to draw branches and then simulate leaves by remaining on the tree for a period of time (see Fig. 5). It also shows some of the sophistication possible in this language.

Expanded examples of this program includes their list of instructions and a name for the list. Once they've created the procedure, the children can set the instructions into action by typing the name of the list.

After some discussion, they agree to combine their first initials to create their own special name for this square. They name it JJ. They change modes and enter the editor to give the computer their list of instructions. They type:

```
TO JJ
FORWARD 36
RIGHT 90
FORWARD 36
RIGHT 90
FORWARD 36
RIGHT 90
FORWARD 36
END
```

Now the computer knows how to run JJ, so Jenny and Joey can direct the turtle to draw a square by typing JJ as often as they like. They will find ways to use it as a subprocedure in a superprocedure.

In the future, this JJ square might form the trailer for a truck, the outline of a head, the basis for a star, or a repeated tile pattern in alternating colors (see Fig. 1).

During this first session on the computer, Jenny and Joey developed problem-solving skills, used turtle geometry, wrote a computer program, and created a building block for future geometric designs.

This is a powerful experience for most children. Beyond using the same version of JJ over and over, they can edit the procedure as their knowledge of the language increases. The same set of instructions with some minor changes becomes:

```
TO JJ2 :SIZE
FORWARD :SIZE
RIGHT :SIZE
FORWARD :SIZE
RIGHT :SIZE
FORWARD :SIZE
RIGHT :SIZE
FORWARD :SIZE
END
```

This set of instructions creates a box of any size depending on the number typed in for :SIZE. With a third edit, the last line of JJ3 could be JJ: SIZE + 10, creating a new box ten turtle units longer on each side than the one before, and continuing forever (see Fig. 2).

The children could add many embellishments in the future, such as pen color and background color. A stop rule can end the growing screen full of JJs just before it wraps. Or you can combine it with a test rule that, when satisfied, prints a congratulatory statement.

Using this square is a powerful exploration of geometry. The turtle graphics aspect of Logo is important to many elementary schools that are introducing it as a first programming language. ■

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are explained comprehensively in the manual. I made a typing error in copying the program and spent a couple of frustrating hours attempting to locate the bug. The error messages did not indicate the line and level where the problem occurred.

The debugging process is a major flaw in this language. For example, I tried out the Print command combined with the command XLOC. I expected a print statement to provide the X coordinate of the turtle's location on the screen. Instead, an error message appeared on the graphics screen (not on the text portion). In addition, the screen started scrolling as I attempted to recover from the bug.

I typed FD 40, and created a shadow turtle printed at the turtle's original position. I reproduced these bugs several times and was only able to get rid of them by hitting break (see Fig. 6).

Logo developers at MIT spent a great deal of energy on plain English error messages for debugging. Color Logo gives the user an inadequate set of tools to fully learn this skill. It also hinders teaching students by using Color Logo. Teachers will find debugging difficult with only seven error messages.

"Teachers will find debugging difficult with only seven error messages."

In the Edit mode, Color Logo differs in several ways from other Logo editors. You enter the editor by hitting break and typing E. The cursor appears at the beginning of the editor, even if you've already entered several defined procedures. To define a new procedure, you must move the cursor past any procedures already present.

A plus for the Color Logo editing system is that you can indent when writing a program. This allows you to write the program in an easy-to-read format.

Also, if you have a printer, a young child can use the Color Logo editor as a simple word processor. Children like to revise and print out stories and letters; the indentation function gives them the flexibility to create the note in Fig. 7.

Several of the inconsistencies between Logo and Color Logo are resolved in the Edit mode. For example, you can write programs in Edit with as many commands on a line as you wish. You can also use repeat in the Edit mode.

Although these features of Color Logo's Edit mode are consistent with Logo, they reinforce a sense of inconsistency in the language's internal logic. The student finds that he must use unfamiliar commands to define procedures, even though those commands are useless in the Run mode. He cannot experiment with them unless he incorporates them into an Edit procedure.

This inconsistency is a problem for the young child and his teacher. They lose the immediacy of experimentation possible with commands that function in the Run mode.

In General

I am delighted to find a turtle graph-

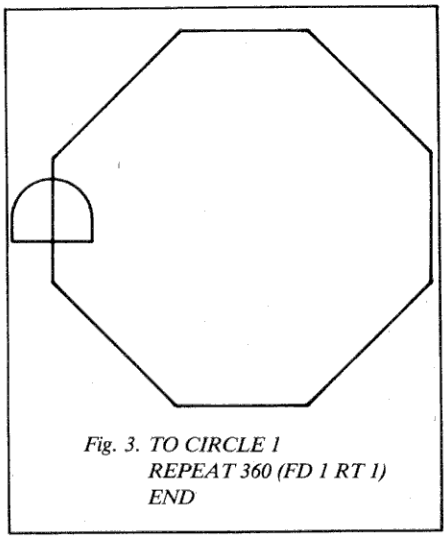

Fig. 3. TO CIRCLE 1
REPEAT 360 (FD 1 RT 1)
END

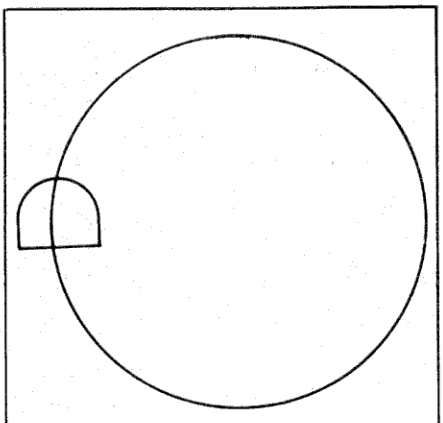

Fig. 4. TO CIRCLE 2
REPEAT 36 (FD 10 RT 10)

```
TO TREE :S
IF ME = 0 (CLEAR SY 0)
IF :S 6
      (FD :S LT 30
      HATCH ! TREE ( 3* :S/4 )
      RT 60
      HATCH 2 TREE ( 3* :S/4 )
      VANISH )
 ELSE ( REPEAT 500 )
 END
```

Program Listing 1

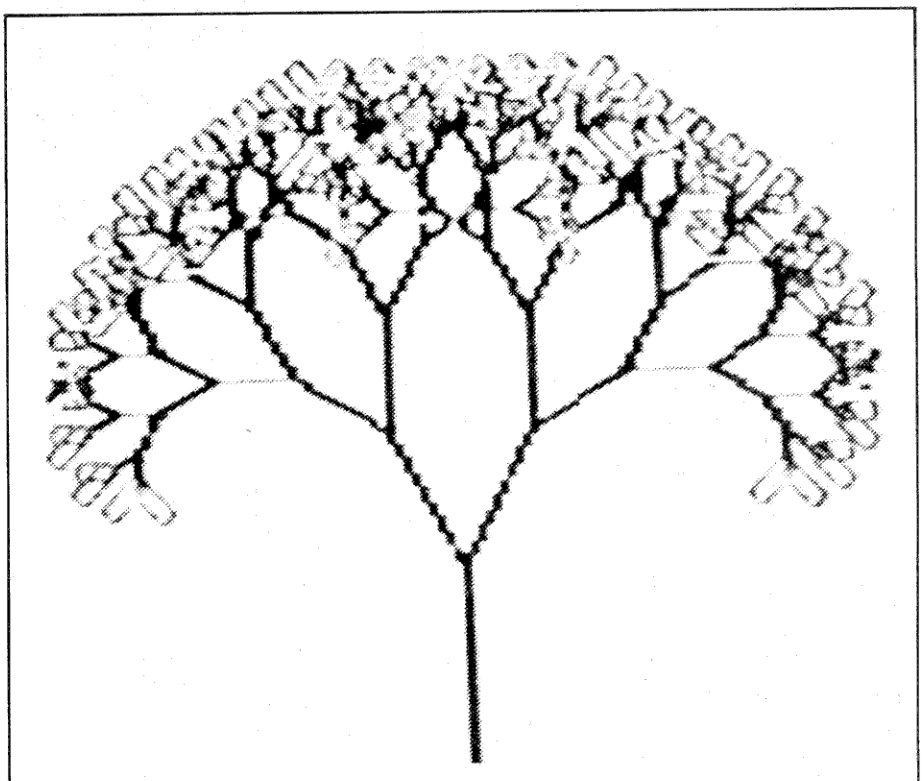

Figure 5

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ics language available for an inexpensive system. I recommend that all owners of the Color Computer who work or live with children get Color Logo. It's fun to use and easy to learn. It provides a powerful structure for problem-solving and encourages mathematical thinking.

Special features, such as hatching extra turtles and changing the turtle's shape, provide new possibilities for animation. The inclusion of variable inputs and recursion provides some of Logo's greater power. The simple word-processing possibilities provide more curriculum connections for young children.

Teachers and parents who do not own a Color Computer should recognize the limitations of this turtle graphics language. My recommendation is to go for the more consistent full Logo implementation if possible. It offers more precise, useful error messages for debugging and developing advanced programming skills. Besides, the turtle graphics in other implementations are truer to the mathematics created by the user during exploration and play. ■

Contact Molly Watt at Gregg Lake Road, Antrim, NH 03440.

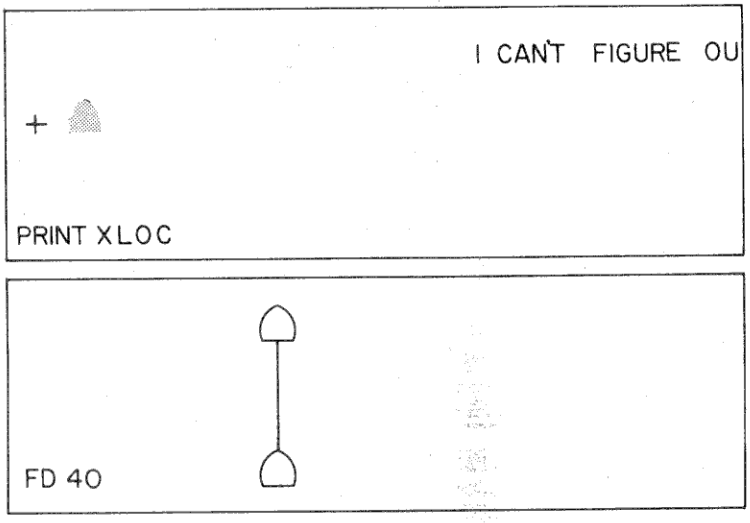

Figure 6

JULY 11, 1983

DEAR RACHEL,
I AM HAVING A BIRTHDAY PARTY ON SATURDAY. WE ARE GOING TO GREGG LAKE TO SWIM. MY DAD IS OUR DRIVER.
THE PARTY IS FROM 1-5.
I HOPE YOU CAN COME!
LOVE,
MOLLY

P.S. BRING YOUR BATHING SUIT!

Figure 7

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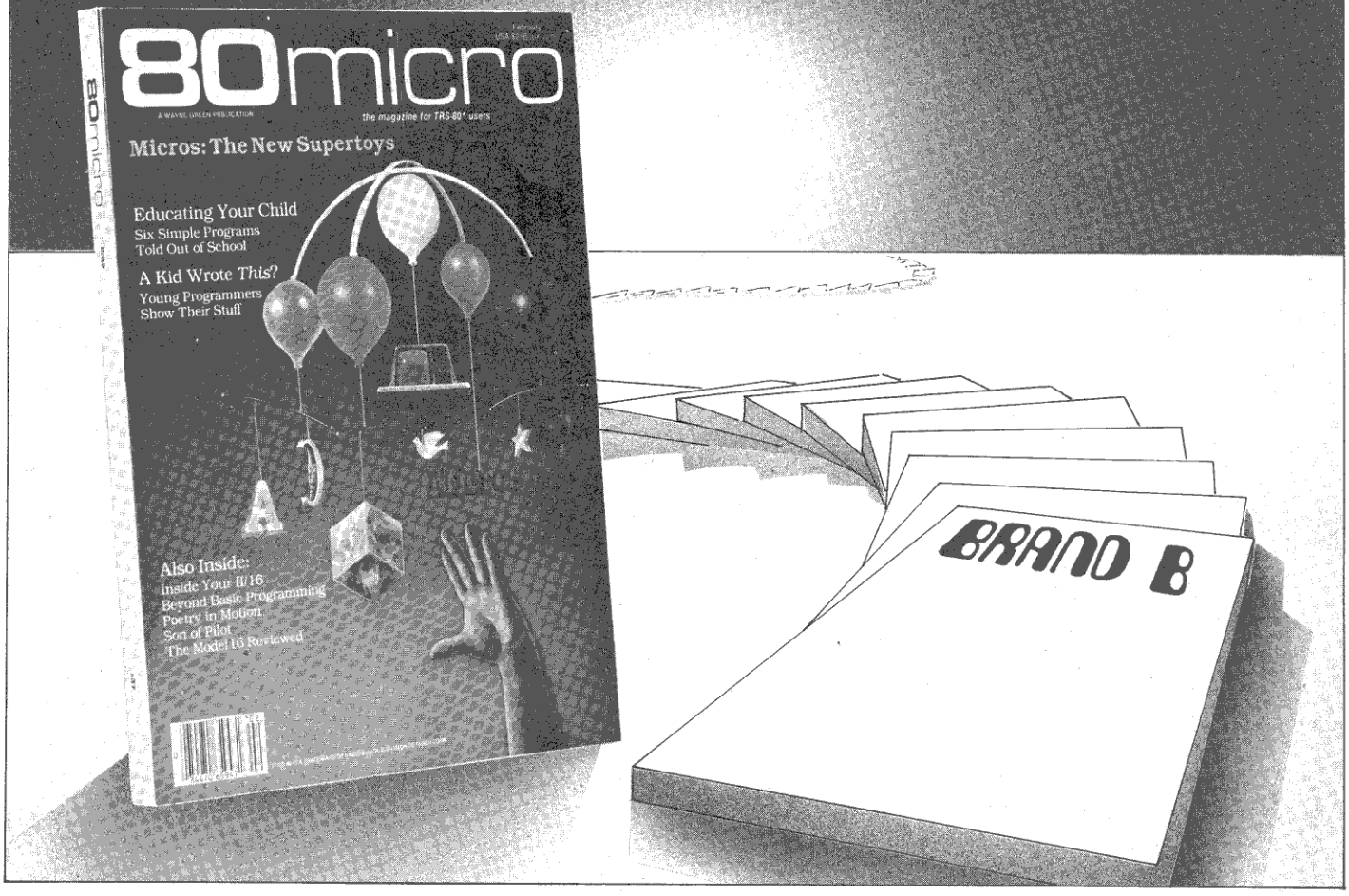

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A History of Programming Languages

by Alan Neibauer

This article traces the development of major programming languages from the days of wires and switches to modern programming dialects.

Some computer users feel that the history of computer languages should read like Genesis: Fortran begat Cobol, Cobol begat Basic, and so on. Unfortunately, programming languages were not created with the same overall plan as life on earth.

In the early days of computers, beginning with the ENIAC of the early 1940s, computer programs were controlled by thousands of wires and switches. The wires and switches physically controlled the flow of electrons through the computer and, consequently, the machine's performance. Each program required a different electronic configuration, and rewiring from one task to another took hours.

With the invention of the IBM Card-Programmed Calculator (CPC) in the late 1940s, programming took a giant step forward. A set of prewired special-purpose boards performed generalized functions.

These boards made the CPC emulate a floating-point machine with built-in functions like square roots, sines, and exponents. The CPC was still not a saved-program computer that allowed convenient program storage and execution.

In essence, these computers understood only machine code—a series of bit configurations that the computer converted to internal operations. Each code gave the machine one instruction, similar to throwing one switch or plugging in one wire on the ENIAC.

This method of programming caused immense difficulties. It took a great deal of time to develop and enter substantial programs into the computer. The process was cumbersome and error-prone, resulting in programs that were hard to debug. As hardware became more sophisticated, the realization that computers were useful and efficient tools focused interest on automatic programming.

Wanted: Languages

The new goal was to design systems, or languages, that would make it easier for the programmer to write programs, and that the computer would automatically convert into machine code through the compilation process. One such effort centered around MIT (Massachusetts Institute of Technology) and the Whirlwind computer, developed between 1947 and 1951.

Dr. Grace Hooper of the Eckert-Mauchly Computer Corporation led the first commercial effort at automatic programming. The Univac I was programmed in mnemonic code, what we now call Assembly language. This was still rather clumsy and required several instructions to produce simple functions. Because Assembly code is still close to the language in which the computer works, it is considered a low-level language like machine code.

Dr. Hooper's group continued working, however, and laid the groundwork for most current high-level languages. A high-level language's syntax is far removed from the machine's internal workings and, ideally, is more easily understood by humans. Dr. Hooper believed that all programming should be at this level in problem-oriented languages. Her efforts resulted in several compilers.

The A2 compiler, which uses a series of floating-point subroutines in main memory, was most widely used. The compiler, which depended on a sequence of compiling instructions, acquired a form of pseudo-code after May 1954.

The Algebraic Translator AT3 (called Math-Matic) was not a commercial success but contributed a number of concepts to Algol, a high-level language discussed below. AT3's use was limited because the Univac, for which it was designed, became obsolete as a scientific computer before the language was completed.

Finally, the B0 compiler, Flow-Matic, played a major role in the development of Cobol. Released in 1956, Flow-Matic relied heavily on English-like syntax and was one of the first languages suitable for business applications.

Meanwhile, another Univac team was working on their own compiler. Anatol Holt and William Turanski developed the GP (Generalized Programming) system based on hierarchies of library subroutines.

The language was later extended to GPX for the Univac II. For the first time, a computer language primarily considered the structure of computer systems, program segmentation, and

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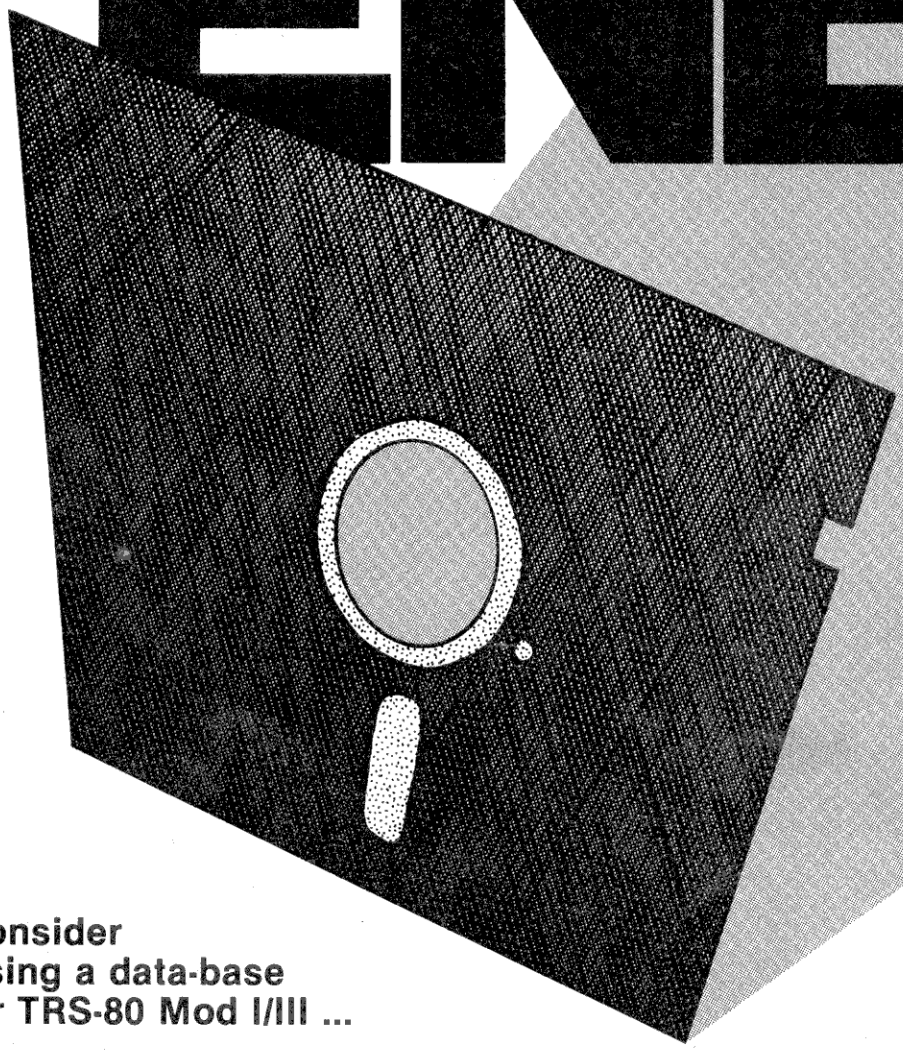

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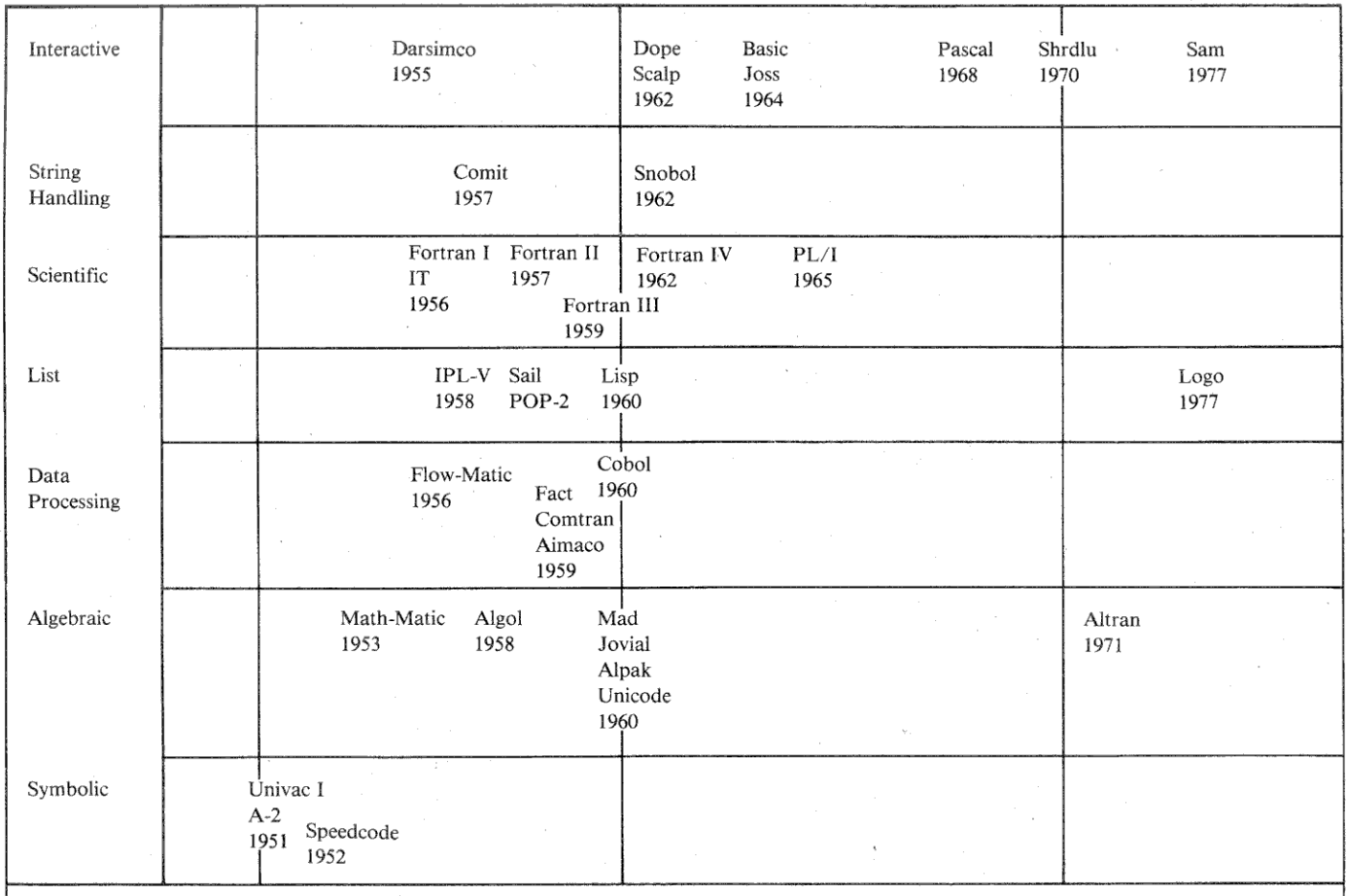

Table 1. Historical development of programming languages. Left column is the theoretical purpose of each language or those that led to its development.

memory allocation.

While all this activity was going on at Univac, the folks at IBM released the IBM 701, one of the first commercial large-scale computers. It utilized the Speedcode language, which was easy to program but slow in operation. The Pact system was next, but it suffered the same fate as AT3—by the time it was ready for the 701, the machine was obsolete.

The development of the medium-size magnetic drum spurred software evolution. A number of interpretive languages appeared and the IBM 350 demonstrated how proper data placement on the drum could optimize programming efforts.

Soap (Symbolic Optimizer and Assembly Program) took advantage of these features. Unfortunately, progress in other languages limited its usefulness.

Dr. Al Perlis, who developed an algebraic compiler for Purdue University, wrote the IT compiler at Carnegie Tech. IT took alphanumeric card input from the IBM 650 and produced a program in Soap. Later, a program called Fortransit translated Fortran into IT, through Soap to machine language.

Again, hardware technology directed the progress of computer languages. The IBM 704 computer, using magnetic core memory in place of electrostatic tube storage, incorporated many improvements over earlier machines.

Fortran Emerges

While developing the 704 in 1954, IBM made John Backus leader of a team assigned to write a high-level, automatic program language for scientists, mathematicians, and engineers. According to Backus, the team, including Irving Ziller, Harlan Herrick, and Roy Nutt, "simply made up the language as they went along."

In April 1957, after some 25 man-years of work, the team produced the first Fortran (FORmula TRANslation) compiler.

Fortran didn't always work at first, but, after modifications and improvements, it did produce executable code. The relatively easy-to-use language promoted practical use of computers.

Since that time, several versions of Fortran have resulted in various enhancements. Fortran II appeared in 1957, followed by Fortran III and Fortran IV in 1962. Although IBM did not design the language to be universal, it received wide acceptance by hardware manufacturers.

The power behind IBM and its user's group, SHARE, stimulated the growth of Fortran. In May 1962, a committee tried to develop standards for the language. In 1966, the American Standards Association (now the American National Standards Institute—ANSI) published its guidelines.

The committee standardized two Fortran languages. Basic Fortran, formally called USA Standard Basic Fortran, was for smaller computers, while USA Standard Fortran (or simply Fortran) was for larger machines. Later, Fortran VI would be developed, but renamed PL/I.

Interest in computer languages was also growing in Europe. A European computer group, GAMM, was interested in developing an algebraic compil-

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er for a variety of machines that might result in a universal standard. Because of the international complications of the effort, Dr. Perlis and John Backus were named to its American faction.

While the group eventually gave up on an international language, it issued a report, *The Preliminary Report on an International Algebraic Language*, in the spring of 1958. The language, initially called IAL, became known as Algol. Later versions would include Algol 58, Algol 60, and Algol 68.

Many other teams worked on algebraic languages based on the Algol model. Burroughs developed the Balgol compiler. The Systems Development Corporation created Jovial (Jules Schwartz' Own Version of the International Algebraic Language). The University of Michigan created the Mad language and the Naval Electronics Laboratory developed Neliac.

The American representatives did not suggest Fortran as a base for the new language, although it was certainly popular in the United States. By mid-1959, most computers accepted Fortran and it seemed a universal language in this country.

However, since Fortran was an early compiler, several of its features were awkward. It served primarily as a compiler language for the IBM 704, not as a computer-independent program. Some members of the ACM committee felt this ruled Fortran out as a universal program.

Also, there was a close connection between the language's popularity and IBM's growth. IBM was the largest of the mainframe companies. Some committee members did not want to encourage IBM's monopoly by declaring "their" language the international standard.

IBM and SHARE gave some support to the new language. SHARE formed an IAL group to help implement Algol on the IBM 700 computers. However, the group was too small a minority in the organization and the effort was never successful.

Since Algol and Fortran were not related, a growing acceptance of the newer language would only diminish the other. SHARE's primary concern was the enhancement of their IBM computers and the Fortran language.

Other algebraic languages include Alpak and its successor, Altran, from Bell Laboratories, and SAC-1, a large collection of Fortran subroutines. Unfortunately, Algol never achieved commercial success in this country, and few manufacturers support it.

Government Involvement

One of the few organizations that could afford complex systems, and would require complex languages, was the United States Government. The government needed a new language that would be compatible with many computers and suitable for data processing, not scientific applications.

In 1959, the Secretary of the Defense called a meeting to attack this problem. Representatives of major manufacturers, users, and academic institutions attended. The meeting started Codasyl, the Committee on Data Systems Languages.

Up to this time, no one had paid much attention to business applications for computer languages. Academic and scientific uses were the main concern. Even the first data processing compilers, the B0 or Flow-Matic, were limited by hardware inadequacy. Other attempts at such a language included Aimaco (Air Material Command, 1959) and IBM's Comtran (1959).

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Matic had these features, the Univac I was slow with extremely long compiling times.

The Codasyl committee took their project to heart. Because of the urgency reflected in the government's request, two separate committees went to work. The short-term committee reviewed existing languages and techniques and made recommendations to Codasyl. An intermediate committee examined these recommendations.

The short-term group felt the needs of the committee could be best served by developing a new language—Cobol. By the time they forwarded their report to the intermediate group, Honeywell had released the Fact compiler. Members of the intermediate group believed that the Fact language was a more suitable base for the common business language.

The short-term committee did not want to see their efforts wasted, and a power struggle ensued. With the eventual support of the Codasyl executive board, Cobol was finally accepted.

The committee's language was first released in an April 1960 report. A maintenance group formed to refine and improve the language, resulting in Cobol 61.

Although the language was a joint effort of many manufacturers, everyone didn't work together in total harmony. Honeywell's powerful Fact compiler went far beyond Cobol's initial parameters.

Fact was a data processing compiler that relied on English syntax and worked for configurations as small as 4K. While it had a great influence on the development of Cobol, Fact fell under the pressure of Cobol's supporters.

After the first Codasyl report, RCA and Remington-Rand rushed to produce the first Cobol compiler. Because of its support of Fortran, IBM stayed out of the competition.

By December 1960, RCA and Remington had Cobol running on their machines. The effort's most significant aspect was that both manufacturers ran the same Cobol program on their own computers. It seemed that the government objective of compatible software had been reached.

With several compilers available, Cobol became widely accepted. Although it was not the only data processing language and some companies resisted its development, the United States government propelled it into a commercial success.

The government refused to purchase or lease computer equipment unless a Cobol compiler was available for it or the manufacturer could prove that such a compiler was unnecessary. With the full weight of the government behind it, Cobol did become the COmmon Business-Oriented Language.

Historically, Cobol owes much to other attempts at creating a universal data processing compiler. Many of the features of Fact were considered in later versions of Cobol, and Univac's Flow-Matic (originally B0) set many of the initial standards.

It was one of the first compilers to use full data names (TAXES-DUE) instead of symbolic ones (TXDU) and utilize complete English words as commands. This influence is usually cited in most Cobol manuals, with a formal acknowledgment to Flow-Matic.

Cobol 61 was followed by Cobol-61 Extended in 1963, then Cobol-65, and Cobol-68. Starting in 1968, Codasyl began publishing a journal of development announcing periodic improvements. The American National Standards Institute (ANSI) approved a version in 1968, and approved revised standards in 1974 known as American National Standard Cobol 1974.

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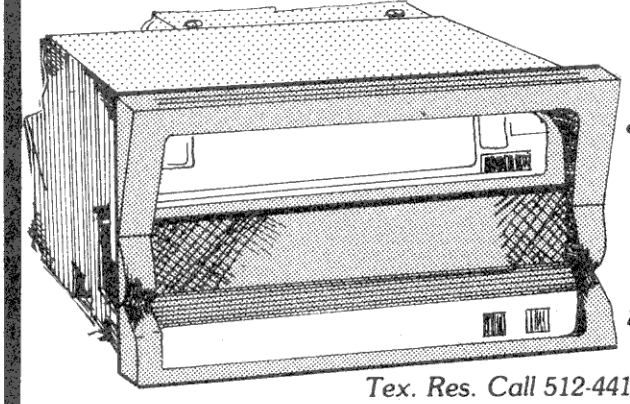

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The Quest for Perfection

Those who still searched for the perfect language moved away from data processing compilers like Cobol. One group developed when an effort to create Fotran 6 was abandoned in hope of finding a new idea.

In October 1963, three representatives of IBM and three members of the SHARE user's group formed the Advanced Language Development Committee. Their goal was to develop something called NPL (New Programming Language), later changed to MPPL (Multi-Purpose Programming Language), and finally to PL/I. The Committee hoped to write a language suitable for both scientific and business users, so the two groups could communicate and share programs.

Because of IBM's influence, the focus of the new language was to be their OS/360 operating system. While the group intended to develop a new Fortran, it soon decided to take other directions. Since the new effort would not be compatible with Fortran, the group selected NPL as a title that would relate the language to IBM's new product line.

IBM was concerned about releasing PL/I with their new operating system. The IBM work group, which first met in October 1963, was supposed to complete the language definition by December of that year. The deadline was extended to February 1964, but the language was too late for the release of OS/360.

By April 1964, the group released the "Specifications for the New Programming Language," followed by a second version, "Report II of the SHARE and Advanced Language Development Committee" in June 1964. As with Cobol and Fortran, IBM refined the PL/I language until release of the 1976 PL/I American National Standard.

Although the language was a new one, the committee drew upon its experiences with Fortran, Cobol, and Algol. Some claim that IBM hoped PL/I would replace both Fortran and Cobol and become a more universal language. However, other manufacturers have made little movement toward the language.

IBM was working on many other languages for their family of computers. One system, RPG (Report Program Generator), allowed the easy generation of reports on their 1401 system. Since RPG's first release in the early 1960s, IBM has announced RPGII for the IBM System/3 computer and RPGIII for the System/38.

Cobol, Fortran, Algol, and PL/I are only a few of the many high-level languages developed over the past three decades. In fact, some 200 or more computer languages have been implemented since the 1950s, with over 100 more no longer in use.

Other Language Functions

While the scientific and data processing goals of compilers played a dominant role in software development, scores of other languages have evolved for list or string processing applications, or specialized functions.

Of the list processing languages, IPL-V (Information Processing Language V) is among the oldest; it was first released in 1958. Allan Newell at the Rand Corporation developed the language as one of the first to use memory cell lists linked with pointers. Other list processing dialects are Sail, POP-2, and Slip, a descendant of FLPL, KLS, Threaded Lists, and IPL-V. The most popular today seems to be Lisp.

John McCarthy at MIT designed Lisp, which is used mainly for artificial intelligence development. Later, the

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Stanford Artificial Intelligence Project released a new version, Lisp 1.6.

Like other languages in its group, Lisp combined elements of functional programming with a facility for list processing. Lisp has had a great influence on the creation of Logo, another list processing language used in education.

A focus on string processing compilers resulted in Comit, released in 1957. Snobol, string-oriented symbolic language, was a general-purpose compiler of this type first implemented in 1962. D.J. Farber, R.E. Griswald, and I.P. Polansky developed it at Bell Labs.

One of the micro user's favorite languages, Basic, was a late bloomer. Interpretive languages were not respected during the compiler period.

In the mid-1960s it became obvious that another approach was necessary for the nonscientific computer user. At Dartmouth College, a relatively small institution in 1965, a majority of the students were non-science majors. The college wanted to provide computer courses and facilities for these students.

At the time, the school was using a remote time-sharing system and had made some early attempts at developing an interactive language. Professor John Kemeny devised Darsimco (Dartmouth Simplified Code), later dropped because of its inefficiency relative to Assembly code.

Much of this changed when an LGP-30 computer was installed on campus. Because of the time-sharing and nonscience focus of the computer, Dr. Thomas Kurtz and Dr. Kemeny tried to develop a suitable language.

At first the two professors tried their own dialect of Algol—Algol 60. They dropped it in favor of Scalp (a Self-Contained Algol Processor). Later, the school developed Dope (Dartmouth Oversimplified Programming Experiment), but finally settled on Basic (Beginner's All-Purpose Symbolic Instruction Code).

Joss (Johnniac Open-Shop System) was an early attempt to design an interactive language for time-sharing use. While it spawned a number of dialects, it is not used today.

One of the newer languages gaining acceptance is Pascal, named after Blaise Pascal (1623–1662), inventor of an early calculating machine. Pascal is a structured language originally developed by Niklaus Wirth of the Institute fuer Informatik in Zurich, Switzerland. Since its release in 1968, several extensions of the language evolved, and a number of compilers are currently available.

Evolution

This is not the end of the history of programming. Many other languages have developed and been implemented. Ladder, developed by SRI International, deals with large complex data bases. Terry Winagrad at MIT created Shrdlu in 1970 as a natural-language processor. Yale's Roger Schank and Robert Abelson developed a language called Sam in 1977.

Charles Moore created Forth to control telescopic equipment at the Kitt Peak National Observatory. The General Motors Research Laboratories also developed a language called Dyana, an extension to Fortran, to help measure vibrational and other dynamic systems.

No doubt you know of other languages and will learn of more in the future. As computers grow in popularity, new systems and languages develop to serve specific needs and those of users at large. ■

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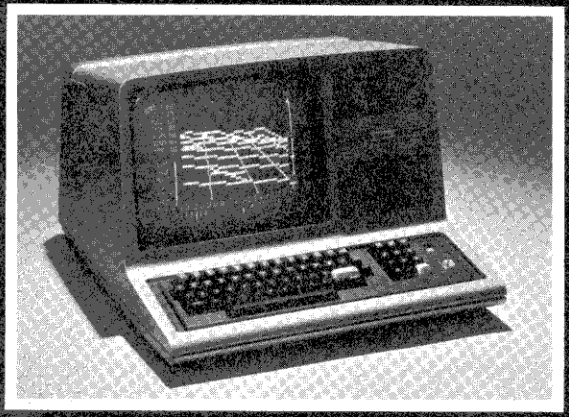

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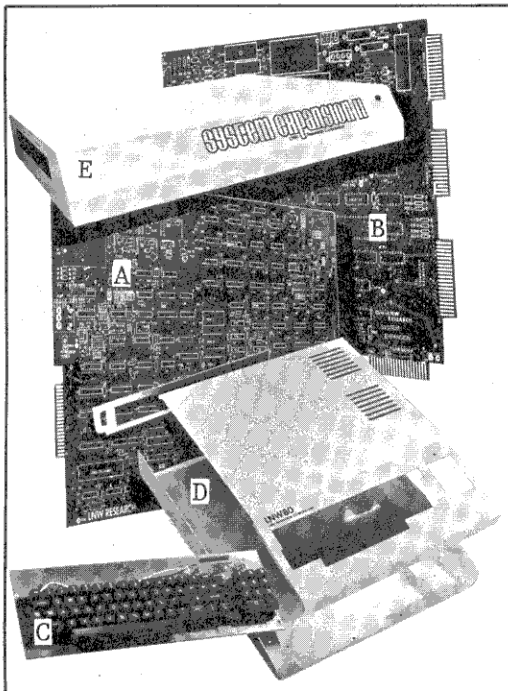

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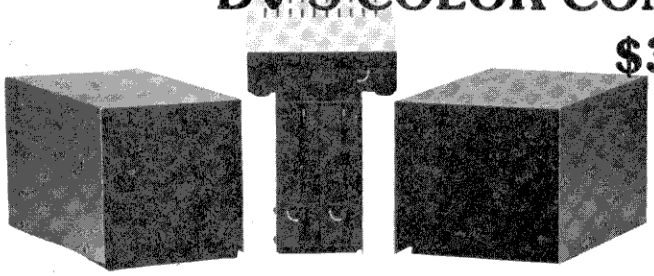

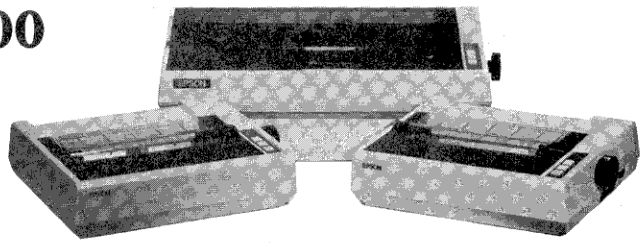

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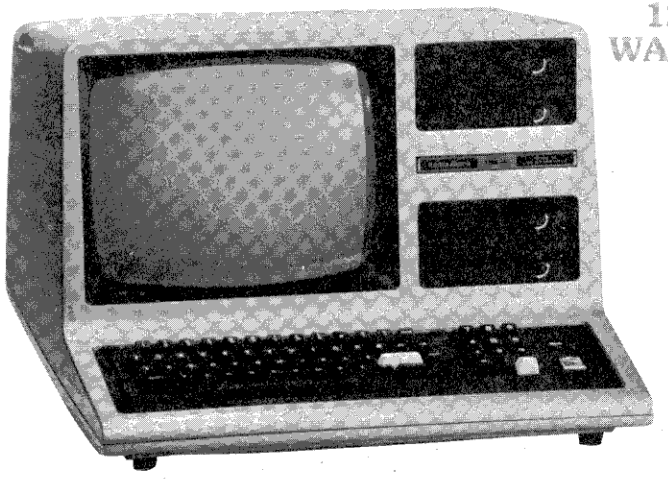

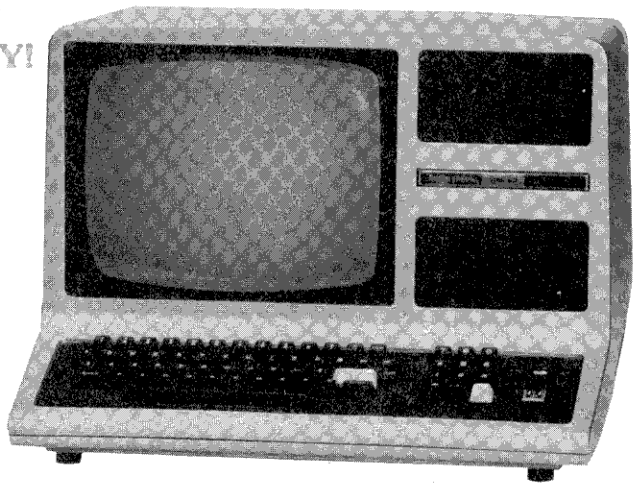

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Service with a Smile

by James H. Nestor

Learn Basic programming on the Model II and keep customer records with this program and the accompanying step-by-step guide.

SERVICE CUSTOMER FILES
Written by J.H. Nestor...1982

Sunday, May 2, 1982

Options:
Enter New Records....1
Read/Update Records....2
Exit the Program....3

Figure 1

Customer File Maintenance Entry Mode Record # 8
Name .... City ....
Address .... State .... Zip ....
Phone 1.... Phone 2....
Service 1.... $
Service 2.... $
Service 3.... $
Service 4.... $
Service 5.... $
Service 6.... $

DATE ITEM AMOUNT
$
$
$
$
$
$

Figure 2

One way to learn Basic programming is to find an interesting program and try to read its code. To that end, I wrote a program for the Model II that I'll go through step by step, describing its functions and features along the way.

The program provided here (see Program Listing), called Service, is one component of a program written for a landscaping business. It records such diverse information as feed and spray schedules, quoted service estimates, and the dates services were performed. Users can enter new-customer information or update current records. Service maintains all this information in a convenient format.

Service's main menu lets you choose to add a new record or upgrade a current one. A third option lets you exit from the program and return to TRSDOS (see Fig. 1).

Adding

When you choose the first menu selection, adding new information to the files, the screen clears and a formatted display appears (see Fig. 2). Each customer is allotted one page of data, divided into three zones on the screen.

Zone 1 contains the customer name, address, and telephone number. Zone 2

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Enter/Edit Keys

Left Arrow moves cursor to the left one space at a time. Does not erase characters in its path.

Right Arrow moves cursor to the right one space at a time. Does not erase characters in its path.

Up Arrow moves cursor to previous field. If already at field 1, Up Arrow is ignored.

Down Arrow moves cursor to the next field. If already at last field on the screen, Down Arrow is ignored.

Enter is the same as Down Arrow.

Tab is ignored.

Backspace moves cursor to the left one space at a time. Erases characters in its path.

Space Bar moves cursor to the right one space at a time. Erases characters in its path.

F1 inserts a blank space at the cursor position. Moves all characters one space to the right.

F2 deletes the character under the cursor. Moves characters one space to the left.

ESC displays options menu at bottom of the screen.

With the exception of ESC, you can use all the keys above in combination with the repeat key.

Table 1

Program Listing

```
10000 DATA      SERVICE/BAS
10010 DATA      SERVICE BUSINESS SCHEDLUING PROGRAM
10020 DATA      written by J.H.Nestor
10030 DATA      revised as of 3/28/82
10040 DATA      adds or updates customer records
10050 DATA      ' '
10060   '
10070 CLEAR 3000
10080 DEFINT A-Z
10090 ON ERROR GOTO 37030
10100 DIM LA$(40),LF(40),C$(40)
10110 DIM RO(40),LC(40),CC(40)
10120 DIM SM$(12),LM$(12)
10130 '
10140 ' set initial variables
10150 '
10160 NF=38 ' number of fields
10170 NE=1:EA$="Customer Number....":EF=3:EO=22:EU=1:CU=20
10180 I$(1)="S E R V I C E   C U S T O M E R   F I L E S"
10190 I$(2)="      written by J.H. Nestor....1982"
10200 P$="* Customer File Maintenance *"
10210 RV$=CHR$(26) ' reverse video
10220 NV$=CHR$(25) ' normal video
10230 ES$=CHR$(24) ' erase to end of screen
10240 OF$=CHR$(2)  ' cursor off
10500 '
10510 ' setup
105?  '
10'   GOSUB 30000 ' read programmer's notes
10540 GOSUB 31000 ' initialize screen variables
10550 GOSUB 33030 ' get the date
10560 '
10570 ' open data files
10580 '
10590 OPEN "R",1,"PAGE1/DAT"
10600 OPEN "R",2,"PAGE2/DAT"
11000 '
11010 ' control menu
11020 '
11030 SS=0
11040 GOSUB 32030 ' display screen header
11050 GOSUB 28030 ' restore original screen variables
11060 PRINT:PRINT TAB(CF)RV$TD$NV$:PRINT
11070 PRINT TAB(22)"Options:":PRINT
11080 PRINT TAB(22)"Enter New Records.............1"
11090 PRINT TAB(22)"Read/Update Records...........2"
11100 PRINT TAB(22)"Exit the program..............3"
11110 PRINT:PRINT TAB(22)"Enter your selection              ";
11120 '
```

Listing continues

lists the services and their cost to this customer. Zone 3 records the services actually provided, charges, and payments received.

In the add mode, the cursor appears in the name field, a reverse video block. Type in the name in that space.

The cursor does not move beyond that block until you press the enter or down-arrow key. Then the program displays the name in normal video, and the cursor and reverse video block jump to the next field, address.

At any time, you can return to a previous field by pressing the up-arrow key. You can also edit data within the fields after you've typed it. Table 1 lists the keystrokes used in entering or editing data.

The left-arrow and right-arrow keys permit movement within a field without erasing any characters in their path. You can move back a few spaces to correct an error, then return to your original position and continue typing. The backspace key and the space bar erase any characters in their path.

The F1 key inserts a blank space into the field at the current cursor position, and moves everything beyond the cursor one position to the right. You can repeat it to open space for inserting characters that you omitted. The F2 key deletes one character at the current cursor position, and moves everything to the left to fill in space.

Screen Options

Pressing the ESC key in any field produces the following options menu at the bottom of the screen:

(S)AVE (E)DIT (P)RINT (M)ENU

To select a command, press the appropriate first letter. The menu responds to either upper- or lowercase characters.

Save writes data from the screen to the disk. The screen clears and the record number counter on the top line advances one digit. The program is ready for you to enter the next page of data.

Edit moves the cursor back to the first field, name. You can change any field on the screen until you press ESC again.

Print produces a message on the bottom of the screen that asks you to press the enter key to print the screen, or the ESC key to return to the options menu. Pressing enter sends the contents of the screen to your printer. The printout stops after the last data field on the screen. The options menu is not printed.

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The scenario is that you are the King of Jerusalem and have to rule your Kingdom from 1169 to 1177. Your ultimate aim is to prevent any incursions by the invading Saracens. You have a total of forty-eight fortresses, all interconnected by caravan routes. The program will pick these off one by one, unless you can defeat the Saracen army in the field, by gathering together an army for yourself from the various garrisons.

Each year consists of six (bi-monthly) moves. At the end of each year (at play rating 6), you will find a new Saracen army moves into the Kingdom from enemy territory. All Saracen armies that stay in the field for a year are reduced by desertions.

The program itself has an artificial intelligence, in as much as the Saracens attempt to seige and take castles and fortresses that they have not previously moved to. In this way a Saracen army that has been seiging for a few years may be reinforced by a new army, which may be sufficient troops to affect the taking of the fortress.

However, your troubles do not stop there! You have to provide food for garrisons and your assembling army. If you find a garrison is under seige, the only way to give them food is to send a caravan, which costs money!

The program is menu-orientated and a map is supplied for both the Northern area and the Southern. The graphics are good, and both Crusader lines and Saracen lines are also displayed, again with an appropriate map. The caravans, of course, are used to transport food from town to town and when this option in the menu is selected then the 5 available caravans are displayed on the screen. You then have four options, to attach or detach food or horses, and to raise or move caravans.

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Listing continued

```
11130 AN$=INKEY$:IF AN$="" THEN 11130
11140 AN%=VAL(AN$)
11150 IF ASC(AN$)=19 OR ASC(AN$)=126 THEN GOSUB 35030:GOTO 11040
 ' show notes
11160 ON AN% GOSUB 12030,13030,36030
11170 GOTO 11040 ' repeat menu
12000 '
12010 ' enter new records
12020 '
12030 MO$="Entry Mode"
12040 R=LOF(1)+1
12050 GOSUB 28030 ' restore original variables
12060 GOSUB 24030 ' clear variables
12070 GOSUB 14030 ' enter/edit
12080 '
12090 GOSUB 15030 ' options
12100 IF ED%=1 THEN 12070 ' edit
12110 IF MU%=1 THEN 12160 ' menu
12120 '
12130 GOSUB 26030 ' write to disk
12140 GOTO 12040 ' next record
12150 '
12160 RETURN
13000 '
13010 ' read/update records
13020 '
13030 MO$="Read/Update Mode"
13040 GOSUB 28030 ' restore original variables
13050 GOSUB 24030 ' clear variables
13060 '
13070 GOSUB 16030 ' enter record #
13080 IF A=27 THEN 13240 ' [esc] - return to menu
13090 IF R>LOF(1) OR R<1 THEN GOSUB 34030:GOTO 13050 ' bad recor
d #
13100 '
13110 GOSUB 24030 ' clear variables
13120 GOSUB 17030 ' get the record
13130 GOSUB 14030 ' display/edit the record
13140 '
13150 GOSUB 15030 ' options
13160 IF ED%=1 THEN 13130 ' edit
13170 IF MU%=1 THEN 13240 ' menu
13180 '
13190 GOSUB 26030 ' write to disk
13200 IF SS=0 THEN 13220 ' test if scan request <--- or --->
13210    R=R+SS:SS=0:GOTO 13120 ' scan
13220 GOTO 13040 ' next record
13230 '
13240 RETURN
14000 '
14010 ' enter/edit routine
14020 '
14030 GOSUB 25030 ' display data on screen
14040 FOR Y=1 TO NF
14050    GOSUB 21030 ' input routine
14060    GOSUB 18030 ' update screen
14070 NEXT Y
14080 RETURN
15000 '
15010 ' options
15020 '
15030 ED%=0:MU%=0
15040 PRINT NV$""OF$;:GOSUB 23030 ' display options
15050 AN$=INKEY$:IF AN$="" THEN 15050
15060 '
15070 IF AN$="S" OR AN$="s" THEN 15130 ' write to disk
15080 IF AN$="P" OR AN$="p" THEN GOSUB 29030:GOTO 15030 ' print
15090 IF AN$="M" OR AN$="m" THEN MU%=1:GOTO 15130 ' menu
15100 IF AN$="E" OR AN$="e" THEN ED%=1:GOTO 15130 ' edit
15110 GOTO 15050
15120 '
15130 RETURN
16000 '
16010 ' get customer record #
16020 '
16030 R=0:GOSUB 25030 ' display screen
16040 PRINT @(23,0),NV$ES$;
16050 GOSUB 27010 ' swap variables
16060 Y=1:PRINT @ (RO(Y),CO(Y)),LA$(Y):C$(1)=STRING$(3,32)
16070 GOSUB 21030 ' input routine
16080 IF Y<>1 THEN PRINT NV$:GOTO 11040
16090 R=VAL(C$(Y))
16100 GOSUB 27010 ' swap variables
16110 RETURN
17000 '
17010 ' get the data files
17020 '
17030 FIELD 1,255 AS CO$
```

Listing continues

Menu returns you to the main menu. It does *not* save data on the disk.

Updating Records

Selecting item 2 on the main menu clears the screen and displays the formatted fields. At the bottom of the screen, the program asks for the customer number. The customer number in this application is the record number from the Add operation. The fifth customer you enter has customer number 5, for example. Entering a negative number or a number larger than the number of files produces an out-of-range message.

Once you've entered a valid customer number, that file appears on the screen. The cursor moves to the first field.

Edit or enter data as in the Add operation. Pressing the ESC key produces the same options list. If you make changes, you must save the screen. Then the program asks you for the next customer number. Press the ESC key to return to the main menu.

Structure of the Program

The Service program is written in Microsoft Basic. It runs in the interpreter mode, or you can compile it using the Microsoft BASCOM compiler.

The program produces two random-access disk files. They are located on any disk drive by changing the drive-spec in the Open statements in lines 10590–10600.

I wrote the Service program in a structured manner. Subroutines are in the order of importance. Only control modules or other subroutines with lower line numbers call subroutines. All subroutines have only one entry point (at the top) and one exit point (at the bottom). I've commented all subroutines, subroutine calls, and major functions in lowercase.

Screen Entry

The method of displaying the fields and accepting/editing data is powerful, easy to use, and allows screen modification for customized displays.

Line 10160 determines the number of fields in the display. Lines 10100–10110 dimension the arrays accordingly. In the interpreter mode, the DIM statements use the variable NF, as in DIM LA$(NF), LF(NF), or C$(NF). But if you compile the program with the BASCOM compiler, the NF variable doesn't work.

All the screen format information is in lines 38050–38420. There is one data statement for each field on the screen. It contains the label of the field, the length

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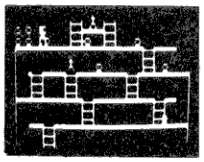
COMPUTER SHACK



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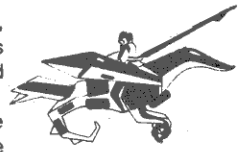
CLASH By Bill Dunlevy



Once again, one of the markets most creative programers, creator of Assault, Jovian, and the ever famous Cyborg, brings to the industry another smash hit! Yes, Bill Dunlevy has created CLASH, a fantastic new arcade simulation!
Mounted upon your great white winged stallion, prepare yourself for a clash within the arena. This day, you will be competeing against famous riders from all over the planet. As the tournament begins, their is a frenzy of flapping wings and bucking horses, but finally all riders are airborne and the contest has begun. With a firm grasp on the reins, manuever your horse above the others and then descend upon them. You must dismount the other riders, before their skill prevails and they dismount you.
Be warned, CLASH is for those riders of skill and reactions! Even one second of carelessness can prove fatal. But for those who love a challenge and an adventure, CLASH, with its multi-levels of play, will definitely become a favorite! Model I/II
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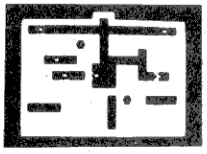

DIG OUT by John Crane

Uh oh! The wackiest game to ever hit an arcade is now invading your computer! Dig Out, that crazy game of dirt and rock will turn your reactions inside out.
As the game begins, you'll find yourself amidst tons of rock and earth. You must dig your way through the surrounding tunnels and hunt down the deadly monsters. But watch out!!! As the hunter, you might just become the hunted. The monsters are strangely powerful, their touch can destroy and their eggs can obliterate. Besides all this, the underground is their natural habitat. With a mere thought, they can move through tons of rock and appear before you. So, you better be quick and your reactions better be good!!!
DIG-OUT is truly another COMPUTER SHACK classic. In each of its fifteen different levels, DIG-OUT combines the best sound, fantastic graphics, and above all, exciting action for a game that surpasses even the original. Model I/III
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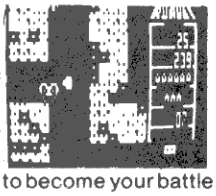
ASSAULT by Dunlevy & Frayer



Strap yourself into the dimly lit ATV (All Terrain Transport), check the motor, the laser's, and visibility, Now prepare yourself for an underground trip that you won't soon forget . . . If you live! After weeks of exploring and mining, you've accumulated quite a tidey sum of gold. But just as you thought the adventure to be over, you stumble upon a part of the mountain that is soon to become your battle ground, if not your grave. These wide open caverns are inhabited by strange creatures set upon stealing your gold and maybe even your life. You can battle them in your laser equipped ATV, but beware! Along the walls grow rather harmless looking mushrooms, that is until you've touched one. But all of this is childs play compared to battling NODRID, the emperor spider of this hellish place. His bloodthirsty fangs will make short work of any unwary adventurer, but you will not find him such an easy prey! Model I/III

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Listing continued

```
17040 GET 1,R ' get file # 1
17050 '
17060 ' disassemble the string
17070 S=1:FOR Q=1 TO 18
17080    C$(Q)=MID$(CO$,S,LF(Q))
17090    S=S+LF(Q)
17100 NEXT Q
17110 '
17120 FIELD 2,255 AS CO$
17130 GET 2,R ' get file # 2
17140 '
17150 ' disassemble the string
17160 S=1:FOR Q=19 TO 38
17170    C$(Q)=MID$(CO$,S,LF(Q))
17180    S=S+LF(Q)
17190 NEXT Q
17200 RETURN
18000 '
18010 ' update screen with inputs
18020 '
18030 PRINT NV$
18040 IF Y<1 THEN Y=1:F=1
18050 GOSUB 19030 ' compute totals on statement
18060 IF Y>NF THEN 18110
18070 GOSUB 20030 ' test if numeric field
18080 PRINT @(RO(Y),CC(Y)),C$(Y)
18090 IF F1=1 THEN Y=0:F1=0
18100 IF Y>NF THEN Y=NF
18110 RETURN
19000 '
19010 ' compute totals on statement
19020 '
19030 V#=0:FOR Q=22 TO 37 STEP 3:V#=V#+VAL(C$(Q)):NEXT Q
19040 V#=INT((V#+.005)*100)/100
19050 V$="            "+STR$(V#):V$=RIGHT$(V$,9)
19060 IF INSTR(V$,".")=0 THEN V$=V$+".00"
19070 IF INSTR(V$,".")=8 THEN V$=V$+"0"
19080 C$(38)=RIGHT$(V$,9):IF VAL(C$(38))=0 THEN C$(38)=STRING$(9
,32)
19090 PRINT @ (RO(38),CC(38)),C$(38);
19100 RETURN
20000 '
20010 ' format numeric fields
20020 '
20030   IF Y< 9 THEN 20250
20040  IF Y= 9 THEN 20200
20050   IF Y=11 THEN 20200
20060   IF Y=13 THEN 20200
20070   IF Y=15 THEN 20200
20080   IF Y=17 THEN 20200
20090   IF Y=19 THEN 20200
20100   IF Y=22 THEN 20200
20110   IF Y=25 THEN 20200
20120   IF Y=28 THEN 20200
20130   IF Y=31 THEN 20200
20140   IF Y=34 THEN 20200
20150   IF Y=37 THEN 20200
20160 GOTO 20250 ' not numeric field
20170  '
20180  ' format to dollars and cents
20190  '
20200   VA#=VAL(C$(Y)):VA#=INT((VA#+.005)*100)/100
20210   VA$="          "+STR$(VA#):VA$=RIGHT$(VA$,8)
20220   IF INSTR(VA$,".")=0 THEN VA$=VA$+".00"
20230   IF INSTR(VA$,".")=7 THEN VA$=VA$+"0"
20240   C$(Y)=RIGHT$(VA$,8):IF VAL(C$(Y))=0 THEN C$(Y)=STRING$(8
,32)
20250   RETURN
21000 '
21010 ' input routine
21020 '
21030 IF Y>NF THEN 21750 ' return on last field
21040 GOSUB 22000 ' print entry block
21050 '
21060 ' get a keystroke
21070 '
21080 PRINT CHR$(1);:A$=INKEY$:IF A$="" THEN 21080 ELSE A=ASC(A$
)
21090 PRINT CHR$(2);
21100 '
21110 ' test for invalid control characters
21120 '
21130 IF A>8 AND A<13 THEN 21080 ' ignore it
21140 IF A>13 AND A<27 THEN 21080 ' ignore it
21150 '
21160 ' test for <- or -> or backspace
21170 '
21180 IF A=28 AND POS(X)>SC THEN PRINT CHR$(28);:GOTO 21080
```

Listing continues

of the field, the row on the screen, the label column, and the data column. You can change the configuration of the screen by changing any of this data.

The order in which you enter the data statements determines the manner in which the cursor moves from field to field. The field described in the first data statement, in this case line 38050, is the first cursor position.

The field in line 38060 is the next. The cursor moves sequentially from field to field. The location of the fields on the screen has no bearing on the direction of cursor movement.

All of the data in the fields is manipulated as ASCII strings. The string array C$( ) contains the data on the screen. For example, C$(1) contains the name data. Padding the strings with blanks (CHR$(32)) initalizes them to maximum length.

Use the MID$ function to insert characters into the data field strings. In the Model II version of Microsoft Basic, you can use MID$ on either side of the equation.

You can see the uses of MID$ in the following examples:

```
10 A$ = "THIS IS A LINE OF STRING DATA"
20 B$ = MID$(A$,11,4)
30 PRINT B$
```

Running this code produces "LINE" as the value of B$.

```
10 A$ = "THIS IS A LINE OF STRING DATA"
20 B$ = "STUPID"
30 MID$(A$,19,6) = B$
40 PRINT A$
```

Running this code produces "THIS IS A LINE OF STUPID DATA" as the value of A$.

These examples demonstrate that you can use MID$ to extract substring data or to insert new data into a string. The input subroutines in lines 21000–21750 use this method to insert keystroke data into the padded data strings.

The input subroutine also tests for the special keys that move the cursor within and between fields, and perform functions such as inserting and deleting characters. The F2 key routine in lines 21330–21390 is a good example. When it detects the F2 key, it determines the current cursor position within the data field string C$(Y) and it divides the string into two parts.

The left portion contains the characters left of the cursor. The right portion contains those characters right of the cursor. The two halves are reassembled in line 21370. A blank space (" ") at the end of C$(Y) adjusts for the character deleted and maintains the

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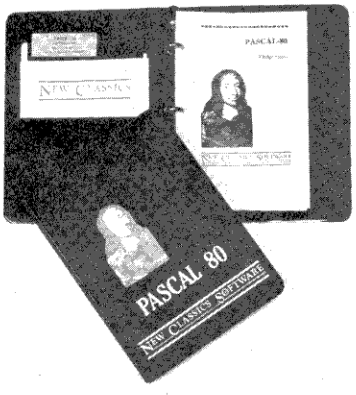

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NEW!! POINTER VARIABLES!

Listing continued

```
21190 IF A=28 AND POS(X)<=SC THEN 21080
21200 IF A=29 AND POS(X)<(EC-1) THEN PRINT CHR$(29);:GOTO 21080
21210 IF A=29 AND POS(X)>=(EC-1) THEN 21080
21220 IF A=8 AND POS(X)<=SC THEN 21030
21230 IF A=8 AND POS(X)>SC THEN PRINT CHR$(8);:MID$(C$(Y),POS(X)
-(SC-1),1)=" ":GOTO 21080
21240 '
21250 ' test for [F1] - insert a space
21260 '
21270 IF A<>1 OR POS(X)>=(EC-1) THEN 21350
21280    PO=POS(X)-(SC-1)
21290    L$=LEFT$(C$(Y),PO-1)+" ":R$=RIGHT$(C$(Y),LF(Y)-PO+1):LR
$=L$+R$
21300     C$(Y)=LEFT$(LR$,LF(Y))
21310     PRINT @(RO(Y),CC(Y)),C$(Y);:PRINT @ (RO(Y),CC(Y)+PO-1)
,"";:GOTO 21080
21320 '
21330 ' test for [F2] - delete a space
21340 '
21350 IF A<> 2 THEN 21430
21360     PO=POS(X)-(SC-1)
21370    L$=LEFT$(C$(Y),PO-1):R$=RIGHT$(C$(Y),(LF(Y)-PO))+" ":LR
$=L$+R$
21380    C$(Y)=LEFT$(LR$,LF(Y))
21390    PRINT @(RO(Y),CC(Y)),C$(Y);:PRINT @(RO(Y),CC(Y)+(PO-1))
,"";:GOTO 21080
21400 '
21410 ' test for up-arrow
21420 '
21430 IF A<>30 THEN 21490
21440    PRINT @ (RO(Y),CC(Y)),NV$;C$(Y)
21450    Y=Y-2:GOTO 21750
21460 '
21470 ' test for down-arrow
21480 '
21490 IF A<>31 THEN 21550
21500    IF Y>NF THEN 21080
21510    IF Y<=NF THEN PRINT @(RO(Y),CC(Y)),RV$;C$(Y):GOTO 21750
21520 '
21530 ' test for [ENTER]
21540 '
21550 IF A<>13 THEN 21590
21560    IF Y>NF THEN 21080
21570    IF Y<=NF THEN PRINT @(RO(Y),CC(Y)),RV$;C$(Y):GOTO 21750
21580 '
21590 ' test for [ESC]
21600 '
21610   IF A=27 THEN Y=NF:GOTO 21750
21620 '
21630 ' test the length
21640 '
21650   IF POS(X)>(EC-1) THEN 21080
21660 '
21670 ' insert the character and display it
21680 '
21690 P=POS(X)-(SC-1)
21700 MID$(C$(Y),P,1)=A$
21710 PRINT @(RO(Y),POS(X)),A$;
21720 '
21730 GOTO 21080 ' get another keystroke
21740 '
21750 PRINT NV$;:RETURN
22000 '
22010 ' print the entry block
22020 '
22030 SC=CC(Y):EC=SC+LF(Y)
22040 PRINT @(RO(Y),CC(Y)),RV$C$(Y)
22050 PRINT @(RO(Y),CC(Y)),"";
22060 RETURN
23000 '
23010 ' display options
23020 '
23030 PRINT" ":PRINT @ (23,0),ES$;
23040 PRINT @ (23,15),RV$" OPTIONS:   (S)AVE    (E)DIT    (P)RIN
T    (M)ENU "NV$;
23050 RETURN
24000 '
24010 ' clear variables
24020 '
24030 FOR H=1 TO NF
24040 C$(H)=STRING$(LF(H),32)
24050 NEXT H:CO$=""
24060 RETURN
25000 '
25010 ' display data on screen
25020 '
25030 CLS:PRINT RV$P$TAB(45)MO$TAB(65)"Record # ";R;NV$
```

Listing continues

fixed length, LF(Y), of the field.

File Handling

The file handling in the Service program uses a different scheme of fielding the files and writes to two files instead of one.

The Field statements in lines 17030–17120 and 26090–26170 contain one variable. You assemble all the data into one string, CO$, which the program writes to the file. The subroutines read only one string from the file, and disassemble it into the field array C$( ).

This method is easy to use, especially when the field lengths or number of fields is subject to change.

I have written the data for Service into two data files because it doesn't fit into a single file. The total record size for each page of data is larger than the 256-byte limit for random-access records.

Lines 26000–26200 contain the subroutine that writes the field data to the two files. The first 18 fields of data are in the first file and the balance of the fields are in the second file. You read a page of data by calling the same record number from both files.

Three groups of data statements are in the screen display routine: lines 10000–10050, 38050–38420, and 38460–38640. The other data statements are of less importance.

Notes

The six data statements at the beginning of the program contain a program heading. I have used data statements instead of remarks so you can compile the Service program with the BASCOM compiler for speedier operation. It is not possible to break and list the program once you have compiled it.

When you've revised a program several times, it is difficult to remember which version is in use. The "Programmer's Notes" subroutines help me determine which version is in use even after I've compiled the program.

When you first run the program, line 10530 executes a GOSUB to lines 30000–30060, where the six data statements are read into string array ST$( ). The Menu routine tests for special characters: in this case, CTRL-S or CTRL-6.

If line 11150 detects either of these control codes, the program branches to the "display programmer's notes" subroutine in lines 35000–35110. This routine clears the screen and displays the information in ST$(1)–ST$(6). It also displays the current amount of memory and string space free.

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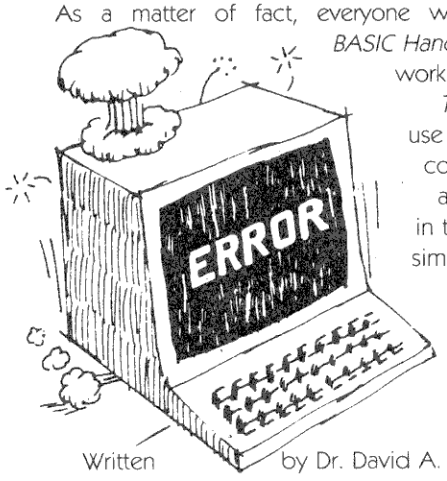

As a matter of fact, everyone who works in BASIC needs *The BASIC Handbook*. It is *the* definitive reference work on the subject of BASIC.

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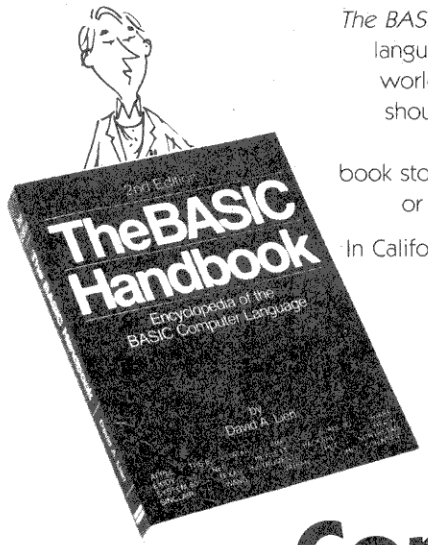

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You can keep any information you wish in the data statements.

The data statements in lines 38460–38640 are used in a date conversion subroutine in lines 33030–33220. This routine takes the DATE$ value from TRSDOS and converts it into a more useful configuration. DATE$ looks like "WedAug141982330". The subroutine creates the variable TD$ in the format "Wednesday, August 14, 1982".

The Service program is easy to operate. It produces a file-card system of information storage and retrieval. Other components of the system enable the operator to print labels, print lists by type of service, and print statements for billing.

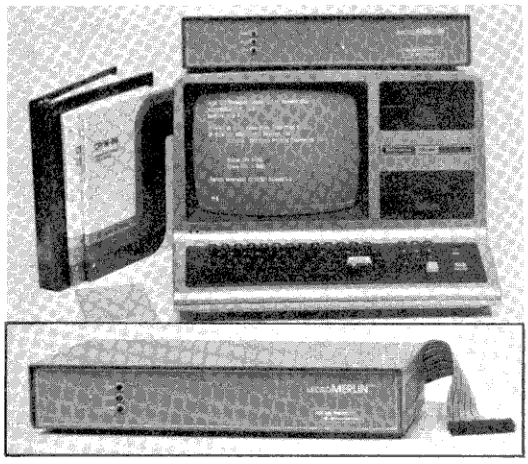
I've written Service for a particular purpose. However, it incorporates a program design that you can easily modify to suit your own needs. ■

J. H. Nestor can be reached at 39114 Route 303, Grafton, OH 44044.

Listing continued

```
25040 PRINT @ (13,0),"------- DATE -------------- ITEM ---------
------------AMOUNT ----------------"
25050 PRINT @(20,0),STRING$(78,"_")
25060 FOR G=1 TO NF
25070    PRINT @ (RO(G),LC(G)),LA$(G)
25080    PRINT @ (RO(G),CC(G)),C$(G)
25090 NEXT G
25100 PRINT @(23,20),RV$"Press ESCape to End the Entry  "NV$;
25110 RETURN
26000 '
26010 ' write to files
26020 '
26030 PRINT @(23,0),ES$;:PRINT @ (23,25),RV$" WRITING TO DISK "N
V$;
26040 '
26050 CO$="":FOR Q=1 TO 18
26060    CO$=CO$+C$(Q) ' assemble string
26070 NEXT Q
26080 '
26090 FIELD 1, 255 AS AA$
26100 LSET AA$=CO$
26110 PUT 1,R ' write to file # 1
26120 '
26130 CO$="":FOR Q=19 TO 38
26140    CO$=CO$+C$(Q) ' assemble string
26150 NEXT Q
26160 '
26170 FIELD 2, 255 AS AA$
26180 LSET AA$=CO$
26190 PUT 2,R ' write to file # 2
26200 RETURN
27000 '
27010 ' swap fields to setup customer # input
27020 '
27030   SWAP NF,NE
27040   SWAP EA$,LA$(1)
27050   SWAP EF,LF(1)
27060   SWAP EO,RO(1)
27070   SWAP EU,LC(1)
27080   SWAP CU,CC(1)
```

Listing continues



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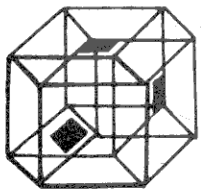

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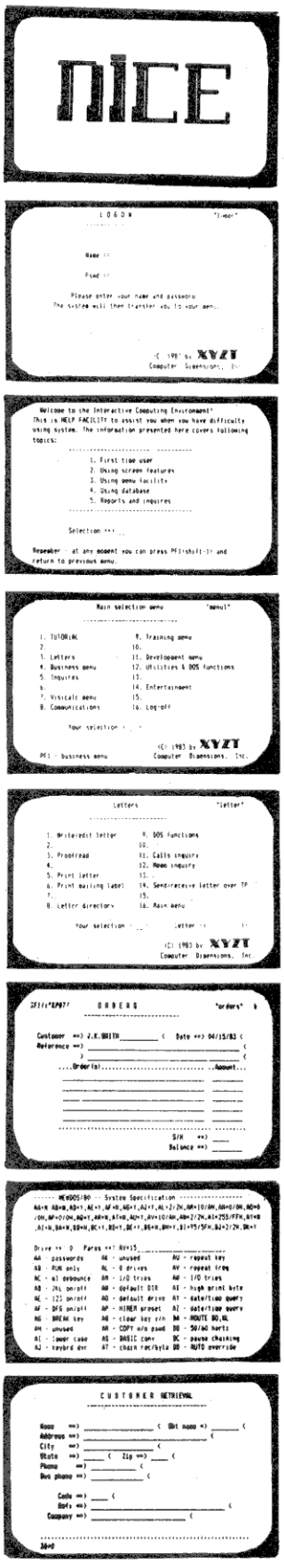

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Listing continued

```
27090   RETURN
28000 '
28010 ' restore original variables
28020 '
28030   SWAP NF,NG
28040   SWAP LA$(1),OA$
28050   SWAP RO(1),OO
28060   SWAP LC(1),OU
28070   SWAP CC(1),UU
28080   SWAP LF(1),OF
28090 RETURN
29000 '
29010 ' print screen
29020 '
29030 RO=ROW(X)-2:PRINT @ (RO,0),NV$;STRING$(80,32):PRINT @ (RO,
15),;"Press ENTER to Print, ESC to Return";
29040 AB$=INKEY$:IF AB$="" THEN 29040
29050 IF ASC(AB$)=13 THEN 29080
29060 IF ASC(AB$)=27 THEN PRINT @ 1680,STRING$(70,32):RETURN
29070 GOTO 29040
29080 PRINT @ (RO,0),STRING$(80,32):PRINT @ (RO,0),"";
29090 PRINT @ (23,0),NV$ES$
29100 SYSTEM "SCREEN"
29110 RETURN
30000 '
30010 ' read programmer's notes
30020 '
30030 FOR A=1 TO 6
30040    READ ST$(A)
30050 NEXT A
30060 RETURN
31000 '
31010 ' initialize screen variables
31020 '
31030 FOR E=1 TO NF
31040    READ LA$(E),LF(E),RO(E),LC(E),CC(E)
31050 NEXT E
31060 NG=NF:OA$=LA$(1):OF=LF(1):OO=RO(1):OU=LC(1):UU=CC(1)
31070 RETURN
32000 '
32010 ' print screen header
32020 '
32030 PRINT NV$:CLS
32040 FOR F=1 TO 2
32050    PRINT TAB(17)I$(F)
32060 NEXT F
32070 RETURN
33000 '
33010 ' date conversion routine
33020 '
33030   FOR X=1 TO 7
33040   READ SD$(X),LD$(X)
33050   NEXT
33060   FOR Y=1 TO 12
33070   READ SM$(Y),LM$(Y)
33080   NEXT Y
33090   FOR X=1 TO 7
33100   IF INSTR(DATE$,SD$(X)) <> 0 THEN DA$=LD$(X):GOTO 33120
33110   NEXT X
33120   FOR Y=1 TO 12
33130   IF INSTR(DATE$,SM$(Y))>0 THEN MO$=LM$(Y):MO=Y:GOTO 33150
33140   NEXT Y
33150   WN$=MID$(DATE$,7,2):FY$=MID$(DATE$,9,4)
33160   YN$=RIGHT$(FY$,2)
33170   MN$=STR$(MO):MN$=RIGHT$(MN$,LEN(MN$)-1)
33180   DN$=MN$+"/"+WN$+"/"+YN$
33190   LD=LEN(DN$):IF LD<8 THEN DN$=DN$+STRING$(8-LD,32)
33200   TD$=" "+DA$+", "+MO$+"  "+WN$+", "+FY$+" "
33210   LQ=LEN(TD$):CQ=INT((32-LQ)/2):CF=CQ+22
33220   RETURN
34000 '
34010 ' bad record number
34020 '
34030 FOR LP=1 TO 3
34040    PRINT @ (22,30),ES$;
34050     FOR DE=1 TO D1:NEXT DE
34060     PRINT @ (22,30),RV$" <--- Record Out of Range "NV$;
34070     FOR DE=1 TO D2:NEXT DE
34080 NEXT LP
34090 RETURN
35000 '
35010 ' display programmer's notes
35020 '
35030   CLS:PRINT TAB(10)"* PROGRAMMER'S NOTES & FILE DATA *":PR
INT
35040   FOR A=1 TO 6:PRINT TAB(10)ST$(A):NEXT:PRINT
35050   PRINT TAB(10)"MEMORY AVAILABLE = ";MEM
35060   PRINT TAB(10)"STRING SPACE =     ";FRE(A$)
```

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  LD H,C
  LD (HL),E
  LD (HL),E
  CCF
  JR NZ,$+5 ", etc.
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```
35070   PRINT:PRINT TAB(10)"(P)rint Screen or ESC to return to M
enu ";
35080   AN$=INKEY$:IF AN$="" THEN 35080
35090   IF AN$="P" THEN SYSTEM "SCREEN"
35100   IF ASC(AN$)=27 THEN RETURN
35110   GOTO 35080
36000 '
36010 ' exit program
36020 '
36030   PRINT:PRINT
36040   CLOSE
36070   SYSTEM
36080   RETURN
37000 '
37010 ' error messages
37020 '
37030 PRINT @ (22,0),RV$" There is an ERROR Type ";ERR;" in Line
 ";ERL;" You must restart this program. "
37040 PRINT @ (23,0)," Check the System for possible problems, T
HEN press ENTER to restart       ";NV$;
37050 AN$=INKEY$:IF AN$="" THEN 37050
37060 CLOSE
37070 RUN "SERVICE/BAS"
38000 '
38010 ' data statements
38020 '
38030 ' label,length,row,label column,data column
38040 '
38050   DATA    Name........,24,2,1,14
38060   DATA    Address.....,24,3,1,14
38070   DATA    City........,15,2,40,51
38080   DATA    State.......,2,3,40,51
38090   DATA    Zip....,5,3,55,63
38100   DATA    Phone 1....,12,4,1,14
38110   DATA    Phone 2....,12,4,40,51
38120   DATA    Service 1....,20,6,1,14
38130   DATA    $,8,6,40,43
38140   DATA    Service 2....,20,7,1,14
38150   DATA    $,8,7,40,43
38160   DATA    Service 3....,20,8,1,14
38170   DATA    $,8,8,40,43
38180   DATA    Service 4....,20,9,1,14
38190   DATA    $,8,9,40,43
38200   DATA    Service 5....,20,10,1,14
38210   DATA    $,8,10,40,43
38220   DATA    Service 6....,20,11,1,14
38230   DATA    $,8,11,40,43
38240   DATA    "",8,14,1,4
38250   DATA    "",20,14,23,24
38260   DATA    $,8,14,53,55
38270   DATA    "",8,15,1,4
38280   DATA    "",20,15,23,24
38290   DATA    $,8,15,53,55
38300   DATA    "",8,16,1,4
38310   DATA    "",20,16,23,24
38320   DATA    $,8,16,53,55
38330   DATA    "",8,17,1,4
38340   DATA    "",20,17,23,24
38350   DATA    $,8,17,53,55
38360   DATA    "",8,18,1,4
38370   DATA    "",20,18,23,24
38380   DATA    $,8,18,53,55
38390   DATA    "",8,19,1,4
38400   DATA    "",20,19,23,24
38410   DATA    $,8,19,53,55
38420   DATA    Total Amount Due... $,9,21,33,55
38430 '
38440 ' data statements for date conversion routine
38450 '
38460   DATA    Sun,Sunday
38470   DATA    Mon,Monday
38480   DATA    Tue,Tuesday
38490   DATA    Wed,Wednesday
38500   DATA    Thu,Thursday
38510   DATA    Fri,Friday
38520   DATA    Sat,Saturday
38530   DATA    Jan,January
38540   DATA    Feb,February
38550   DATA    Mar,March
38560   DATA    Apr,April
38570   DATA    May,May
38580   DATA    Jun,June
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38600   DATA    Aug,August
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Buyer's Guide to CoCo Upgrades and Peripherals

You bought a Color Computer, and you're pretty happy with it. But for some reason, the standard computer isn't enough. You wish it had enough memory for word processing or supported parallel instead of serial communication. You'd like a new keyboard for easier typing, or you want to add joysticks to play games. For whatever reason, you want to upgrade.

Before you can enhance your machine, however, you have to know what products are available. This buyer's guide introduces you to the world of Color Computer hardware. It surveys what's on the market and the price ranges of those products.

Some products listed here require hardware modification; others are peripherals that simply plug in to the system. Only those products designed for the Color Computer are included. Non-specific products that work with virtually any computer are excluded.

The information in this guide was supplied by manufacturers. *80 Micro* has not tested these products and does not guarantee any claims. We encourage you to research a product thoroughly before purchasing it. ■

Basic ROM/ Extended Basic

Basic ROM
$36 plus $3 shipping/handling (s/h)
Spectrum Projects
93-15 86th Drive
Woodhaven, NY 11421
212-441-2807

This ROM uses Basic 1.1, and it is a plug-in chip—its installation doesn't require cutting traces or soldering. Instructions are included, as is a 90-day parts and labor warranty. No extended warranty is available.

Extended Basic ROM
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The Micro Works Inc.
P.O. Box 1110
Del Mar, CA 92014
619-942-2400

You can install this ROM without cutting traces or soldering. Documentation accompanies the product, as does a 90-day warranty.

***Manufacturers marked by two asterisks did not respond to our questionnaire.*

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93-15 86th Drive
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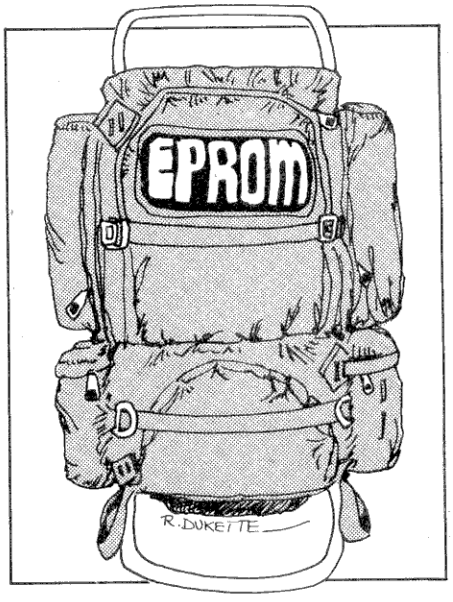
****Extended Color Basic ROM Kit**
$99 (installation not included)
Radio Shack
One Tandy Center
Fort Worth, TX 76102

This ROM provides advanced graphics capabilities for your Color Computer with standard Basic. It requires a minimum of 16K.

Blank EPROM Packs

CMemory
$24.95
Micro-Labs
902 Pinecrest Drive
Richardson, TX 75080
214-235-0915



CMemory supports the 2716 EPROM chip or the 2016 or 6116 RAM chip; it doesn't contain a chip. It has 8K capacity (16K if you piggy-back the memory). The pack has a plastic case and uses EPROMs or RAM or both in 2K blocks. It occupies unused address space and $C000–$DFFF. Instructions are included along with a 90-day warranty.

CMemory-16
$34.95
Micro-Labs

902 Pinecrest Drive
Richardson, TX 75080
214-235-0915

Enclosed in a plastic case, this pack doesn't include an EPROM chip but it supports the 2732 chip. It has 16K continuous memory beginning at $C000, divided into from one to four 4K blocks of EPROM. Instructions and a 90-day warranty are included.

MultiMemory Board
$30 plus $7.50 for the case
Control Craft Inc.
19270 North Hills Drive
Brookfield, WI 53005
414-784-9027

An EPROM chip is not included in MultiMemory, but the board supports the 2516, 2716-5V, 2532, 2732, and 2564 EPROM chips as well as the 2016, 4016, and 6116 RAM chips. The board's capacity is 6 chips or 16K—whichever is greater. It lets you use static RAM as well as an EPROM (type D or earlier) provision for the write-protect switch.

You can replace jumpers with DIP switches. MultiMemory has a gold-plated edge connector and comes with sockets for memory and decoupling caps. Quantity discounts are available. Installation instructions and a 90-day warranty are included.

ROMless Pak I
$24.95
The Micro Works Inc.
P.O. Box 1110
Del Mar, CA 92014
619-942-2400

ROMless Pak I comes in a plastic case and includes a PC board with sockets and discrete components installed. An EPROM chip is not included, but the pack supports the 2716 or 2732 chip, and it has a capacity of 8K. Instructions are included; the hardware has a 90-day parts and labor warranty.

ROMless Pak II
$29.95
The Micro Works Inc.
P.O. Box 1110
Del Mar, CA 92014
619-942-2400

ROMless Pak II is a bare board in a plastic case. Although it doesn't include a chip, it supports the 2716 EPROM chip on the 6116 RAM chip. The product has a capacity of up to 12K ROM or RAM. Instructions are included. The PC board is guaranteed to be free from defects and it has a 90-day parts and labor warranty.

Cooling Fans

CoCo Cooler
$49.95 plus $3 s/h
Spectrum Projects
93-15 86th Drive
Woodhaven, NY 11421
212-441-2807

CoCo Cooler is an internal cooling system that cools chips, especially the heat-prone SAM chip. A 90-day warranty covers the product.

Color Fan
$34.95
Atomic City Electronics
3195 Arizona Ave.
Los Alamos, NM 87544
505-662-3200

Color Fan, a 20CFM fan, cools the Color Computer's interior. It is 3 inches in diameter and mounts under the keyboard. Installation instructions are in-

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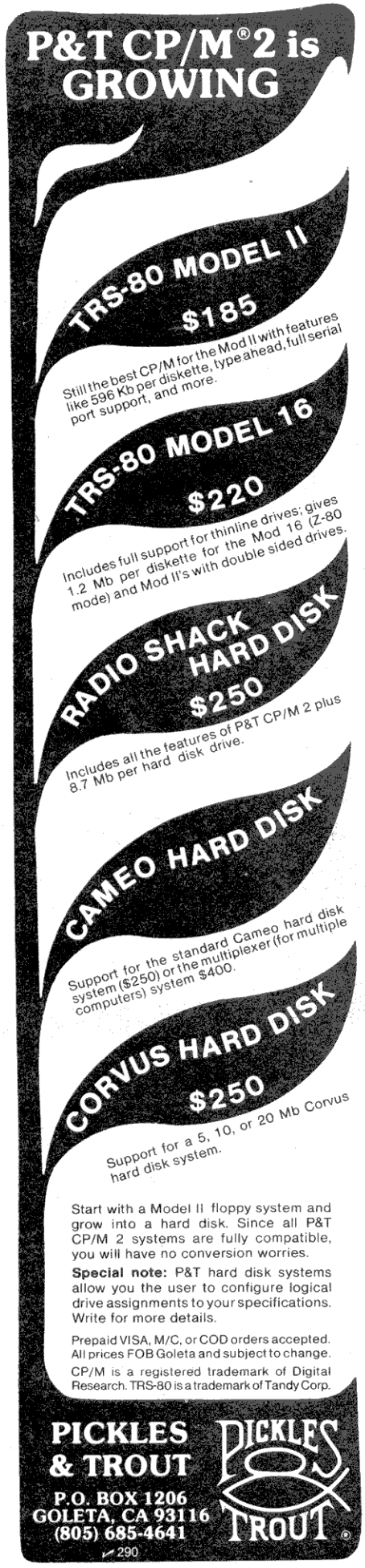


cluded, as well as a 30-day money-back guarantee and a 90-day parts and labor warranty.

Disk Controllers

Atomtronics Disc Controller Board
$274.95 without video
$349.95 with video
Atomic City Electronics
3195 Arizona Ave.
Los Alamos, NM 87544
505-662-3200

The Atomtronics Disc Controller Board controls four 5¼-inch disk drives and uses the 2793 controller chip. It uses the FLEX operating system and doesn't read Radio Shack Color Computer disks. The DOS must be loaded from disk. A formatted 5¼-inch disk (double-sided, double-density, 80-track disk) has 720K capacity.

The controller includes a parallel printer port, a real-time clock, and an optional 80-by-24-character video display. It mounts inside the Color Computer's case, and installation instructions are included. A 30-day money-back guarantee and a 90-day parts and labor warranty cover the controller.

Disk Interface
$199.95 plus $3 s/h
Spectrum Projects
93-15 86th Drive
Woodhaven, NY 11421
212-441-2807

The Disk interface controls four 5¼-inch disks and uses the 1793 controller chip. Using Radio Shack's DOS, it reads Radio Shack Color Computer disks but not Model I/III disks. The DOS is stored in ROM, and formatted disks have a capacity of 165K. The product comes with a two-drive cable, a cartridge, and an owner's manual. It's covered by a 90-day warranty.

TG-99 The Alternative
$159.95 CCMD+9
$199.95 EXTMD9
Cer-Comp
5566 Ricochet Ave.
Las Vegas, NV 89110
702-452-0632

The Alternative controls four 5¼-inch disk drives (single- or double-sided, any mix of 35-, 40-, or 80-track drives). It doesn't read Radio Shack Color Computer disks. The product uses the CCMD+9 or EXTMD9 operating systems stored on a 4K or 8K EPROM pack.

A 5¼-inch formatted disk has 175K RAM of user space in a single-sided 35-track drive and 350K RAM in a double-sided 35-track drive. In a single-sided 40-track drive, the disk has 200K RAM and in a double-sided 40-track drive, it has 400K RAM. The 80-track single-sided drive provides 400K, and the double-sided drive has 800K.

The EXTMD9 is Extended Disk Basic compatible, has on-error handling, an on-screen clock, a full-featured DOS, and a built-in Debug machine-language monitor. Time and date variables are maintained for Basic in string and numeric forms. Installation instructions and a 90-day hardware warranty are included.

EPROM Programmers

EPROM Programmer
$105
Control Craft Inc.
19270 North Hills Drive
Brookfield, WI 53005
414-784-9027

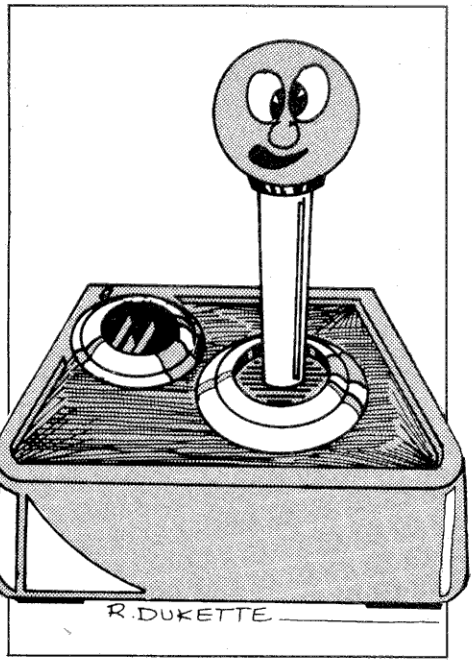
This programmer plugs into the game pack port and lets you produce programs on EPROM. The programmer is self-contained with software on board—no external power supply is needed. It can program the 2716, 2732, 2764, 2516, 2532, and 2564 5-volt EPROMs. Instructions and a 90-day warranty are included.

The Spectrum EPROM Programmer
$99.95 plus $3 s/h
Spectrum Projects
93-15 86th Drive
Woodhaven, NY 11421
212-441-2807

With this programmer, you can program the 2716 and 67864 EPROMs. You can write your own version of Basic or modify regular, Extended, or Disk Basic. Instructions are included, as well as a 90-day warranty.

Joysticks, etc.

Colorcade Super Joystick Module
$19.95
Colorware Inc.
78-03 Jamaica Ave.
Woodhaven, NY 11421
212-647-2864



This module interfaces an Atari joystick (or equivalent) to the Color Computer. It allows electronic rapid fire with variable speed control. The module also serves as a six-foot joystick extender. It comes with instructions and a 90-day parts and labor warranty.

Command Control Adaptor
$17.95
WICO Corporation
6400 West Gross Point Road
Niles, IL 60648
312-647-7500

This adapter works for switch-type joysticks. It includes a circuit board, but its installation doesn't require cutting traces. It has two 9-pin female input plugs and two two-foot adapter cords with 5-pin DIN plugs. Installation instructions are included, as is a one-year limited warranty (you must return the adapter to WICO with $3 and proof of purchase).

Command Control Analog Joystick
$49.95 each
WICO Corporation
6400 West Gross Point Road
Niles, IL 60648
312-647-7500

The Analog Joystick has spring return and a fire button on the stick, and its six-leaf switch design is the same as arcade models. Other features include a steel shaft handle, four non-slip pads, and a five-foot cord. The joystick comes complete with instructions and a one-year limited warranty (you must return it to WICO with $3 and proof of purchase).

Command Control Track Ball
$69.95
WICO Corporation
6400 West Gross Point Road
Niles, IL 60648
312-647-7500

This arcade-type track ball has steel shaft bearings, a phenolic ball, light encoder wheels, and two optical encoders. It has a limited one-year warranty (you must return it to WICO with $3 and proof of purchase).

Double Stick Interface
$19.95 plus $3 s/h
Spectrum Projects
93-15 86th Drive
Woodhaven, NY 11421
212-441-2807

With this interface, you can hook up two Atari-type joysticks to the Color Computer. An extra-long cable for direct plug-in to two joystick ports comes with the product. Instructions and a 90-day warranty are also included.

Endicott Joystick
$19.95 each/$37.95 for two
Endicott Software
P.O. Box 12543
Huntsville, AL 35802
205-881-0506

A potentiometer-type joystick, the Endicott Joystick measures four inches by 2 3/8 inches by four inches and weighs four ounces. It is free-floating, and the fire button is on the base. It has a six-foot cord and plugs in—no modification or adapter is needed. Instructions and a 90-day replacement or repair warranty are included.

****Jarb Dual Joystick**
$35.95 each
Jarb Software Inc.
1636 D Avenue, Suite C
National City, CA 92050
619-474-6213

The Dual Joystick, a potentiometer joystick, has both units assembled in one box. It has two cables, two fire buttons, and two shafts. The fire buttons are on the base. Installation instructions, a text program, and a 180-day warranty are included.

Kraft Joystick
$64.95 each
Kraft Systems
450 W. California Ave.
Vista, CA 92083
619-724-7146

This is a potentiometer-type joystick

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that can be either free-floating or have a spring return—you choose with a switch. The fire button is on the base. Sample programs are not included, but instructions and a full one-year warranty are.

****Radio Shack Joystick**
$24.95 per pair
Radio Shack
One Tandy Center
Fort Worth, TX 76102

Radio Shack's Joystick has 360-degree movement and a single-shot button. An instruction sheet is included.

Spectrum Joystick
$39.95 each plus $3 s/h
Spectrum Projects
93-15 86th Drive
Woodhaven, NY 11421
212-441-2807

This free-floating joystick is a potentiometer. The "soft-touch" fire button is on the base. The joystick has a red LED power on/off indicator, and its cable is nine feet long. The Spectrum Joystick has a 90-day warranty.

Keyboards

Premium Keyboard
$89.95
Micronix Systems Corp.
#7 Gibralter Square
St. Charles, MO 63301
314-441-1694

The Premium Keyboard has 57 keys, four of which are special-function keys. It does not have a separate numeric keypad. You must install the keyboard, but cutting wires and soldering joints isn't required. The keyboard has Alps key switches and a low profile, and it is laid out like the Radio Shack keyboard. Special driver software is included, as are instructions and a 90-day limited warranty.

Replacement Keyboard
$149
Level IV Products
32429 Schoolcraft Road
Livonia, MI 48150
800-521-3305

Level IV Products installs this keyboard externally. It is an Alps keyboard in a Model I bezel. The keyboard has 65 keys (none of which is a special-function key) and a separate numeric keypad. Its cable plugs into the left side of the machine, and the reset button works with this keyboard. Documentation and a 90-day warranty are included.

Word Processing Keyboard
$89.95 plus $3 s/h
Spectrum Projects
93-15 86th Drive
Woodhaven, NY 11421
212-441-2807

The Word Processing Keyboard has 57 keys, including four special-function keys. It doesn't have a separate numeric keypad. The keyboard is a direct plug-in replacement and must be installed inside the computer; you don't have to cut wires or solder joints. The package includes software for user-definable keys, plus instructions and a 90-day warranty.

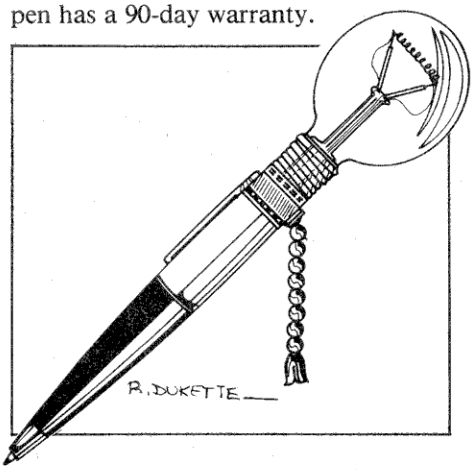
Light Pens

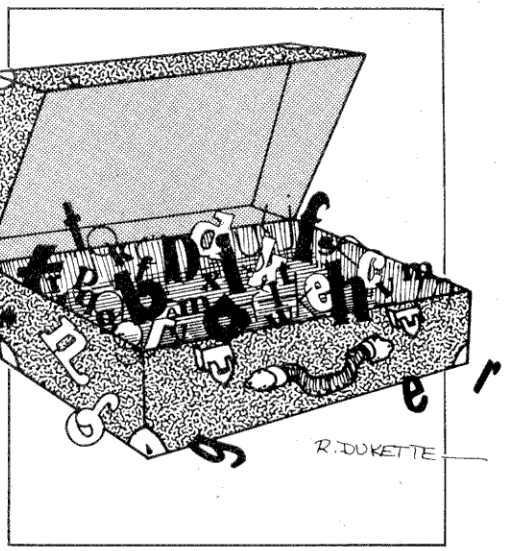
Colorware Light Pen
$19.95
Colorware Inc.
78-03 Jamaica Ave.
Woodhaven, NY 11421
212-647-2864

The Colorware Light Pen plugs into the right joystick port. It doesn't need special driver software, but the package comes with six sample cassette programs (including a light pen menu program and entertainment and educational programs). Instructions and a 90-day parts and labor warranty are included.

Spectrum Light Pen
$19.95 plus $3 s/h
Spectrum Projects
93-15 86th Drive
Woodhaven, NY 11421
212-441-2807

Spectrum's Light Pen plugs into the right joystick port. Five demonstration packages are included, but special driver software isn't needed. The light pen has a 90-day warranty.





Lowercase Kits

LCA-47
$75
Micro Technical Products Inc.
123 N. Sirrine, Suite 106
Mesa, AZ 85201
602-834-0283

The LCA-47 provides true descenders, has a fast, bipolar character generator ROM, and is compatible with 80C software. You can remote two onboard switches—an enable/disable switch and a black-on-green/green-on-black switch. Installation takes about five minutes; cutting traces and soldering aren't required. Installation instructions are included, as is a one-year parts and labor warranty.

Lowercase Kit
$69.95 plus $3 s/h
Spectrum Projects
93-15 86th Drive
Woodhaven, NY 11421
212-441-2807

The Lowercase Kit has a direct, plug-in circuit board. It supplies true descenders and can be installed in about five minutes—cutting traces or soldering are not required. Installation instructions and a 90-day warranty are included.

Lowerkit
$79.95
Green Mountain Micro
Roxbury, VT 05669
802-485-6112

Lowerkit provides true descenders and has optional Kata Kana, Greek, APL, math symbols, and generalized European characters. Special character

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sets can be programmed on request, and character-creation software is available. The kit is a plug-in module; cutting traces and soldering are unnecessary. Installation takes about a minute, and instructions and an unconditional six-month warranty are included.

Parallel Printer ROM Packs

BT-1010 Parallel Printer Port
$79.95 plus s/h
Basic Technology
1500 Kent Road
Ortonville, MI 48462
313-627-6146

The BT-1010 is a plug-in, self-decoded cartridge with a provision for changing the port address location. It has a five-foot cable with a Centronics connector, and it provides an 8-bit port. The pack is user-programmable with an option for other computer-programmable printer controls or inputs. A machine-language driver is included on a tape that is disk-loadable and position independent. A user's manual with operating and installation instructions, schematics, parts lists, and parts layout diagrams is included, as well as a 180-day full parts and labor warranty.

CPrint
$39.95
Micro-Labs Inc.
902 Pinecrest Drive
Richardson, TX 75080
214-235-0915

You must initialize CPrint via software (EXEC 49152). CPrint provides an 8-bit port and is fully buffered, has printer-driver software in ROM, and a fully buffered bidirectional port. It provides a Centronics-type parallel port and has all normal printer commands. You can set line width and page length, and a blank line is automatically inserted between pages. Instructions and a 90-day warranty are included.

RAM Chips

4K–16K Memory Upgrade Kit
$39.95
The Micro Works Inc.
P.O. Box 1110
Del Mar, CA 92014
619-942-2400

This kit turns your Color Computer into a 16K machine. It has plastic RAM with no circuit board; installation doesn't require cutting traces or soldering. Various companies manufacture the RAM, and access time is 200 nanoseconds. Installation instructions are included, and the integrated circuits come with a warranty.

4K–16K RAM Upgrade
$15.95
American Small Business Computers
118 S. Mill St.
Pryor, OK 74361
918-825-4844

This plastic RAM upgrades your computer from 4K to 16K. It has no circuit board, and installation doesn't require cutting traces or soldering. Access time is 200 nanoseconds. Installation instructions and a 180-day warranty are included.

16K RAM
$12 for eight
Total Access
P.O. Box 790276
Dallas, TX 75379
214-458-1966

This product upgrades your computer to 16K; the RAM is either plastic or ceramic and does not include a circuit board. Cutting traces and soldering aren't needed for installation. Access time is 200 nanoseconds. The chips are guaranteed for one year.

16K RAM Chips
$29
Level IV Products
32429 Schoolcraft Road
Livonia, MI 48150
800-521-3305

This ceramic RAM is manufactured by NEC. A circuit board is not included. Cutting traces and soldering might be required, depending on your revision board. Access time is 150 nanoseconds. The upgrade is FLEX compatible. Internal upgrade instructions are included, but the chips do not come with a warranty.

****16K RAM Upgrade Kit**
$49 (does not include installation)
Radio Shack
One Tandy Center
Fort Worth, TX 76102

This kit converts your 4K RAM Color Computer to 16K.

16K–32K Memory Upgrade Kit
$39.95
The Micro Works Inc.
P.O. Box 1110
Del Mar, CA 92014
619-942-2400

With this kit, you can upgrade your 16K RAM computer to 32K RAM. The plastic RAM is made by various manufacturers, and the kit does not include a circuit board. Access time is 200 nanoseconds. Installation instructions are included, and you will have to cut traces and solder. The integrated circuits are warranteed.

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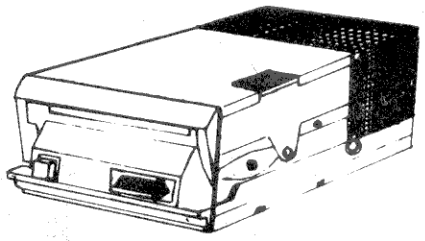
BiTech Micro-Magnum 5 Removable Hard Disk Drive



The Bi-Tech removable-only 5.25-inch disk drive combines proven technology with design reliability. The drive features fulfill the fundamental requirements of a peripheral storage device including mass storage, input/output, and backup. Total capacity of the removable cartridge is 5.0 MBytes.

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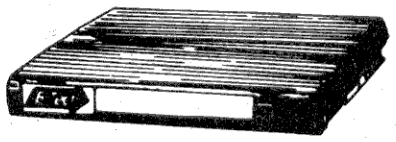
BiTech Micro-Magnum Hard Disk Cartridge



The Bi-Tech removable disk cartridge is used with the Micro-Magnum disk drive. The cartridge is small, lightweight, and portable, yet provides a total storage capacity of 5.0 MBytes.

Both disk surfaces are available for data storage. Pre-recorded embedded servo* information provides for cartridge interchange and servo positioning.

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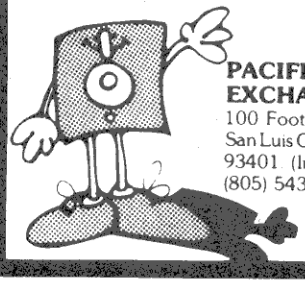

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BIGMEM kit includes 64K RAM chips, A&T controller, cable, solder and instructions ($180). VCXM disk ($34). Utility software disk ($20). Get all three ($224). 64K CP/M 2.2 ($119). USA shipping included. NYS add tax.

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32K RAM
$34.95
B.T. Enterprises
10B Carlough Road
Bohemia, NY 11716
516-567-8155

NEC and AMD manufacture these 32K RAM chips. Access time is 150 nanoseconds. A 30-day warranty covers the product.

32K RAM Chips
$79
Level IV Products
32429 Schoolcraft Road
Livonia, MI 48150
800-521-3305

This ceramic RAM is manufactured by NEC. It doesn't include a circuit board; cutting traces and soldering might be required, depending on your revision board. Access time is 150 nanoseconds. The upgrade is FLEX compatible. Internal upgrade instructions are included, but the chips aren't covered by a warranty.

****32K RAM Kit**
$149 (does not include installation)
Radio Shack
One Tandy Center
Fort Worth, TX 76102

With this kit, you can convert your 4K or 16K RAM Color Computer to 32K RAM.

64K Chips
$49.95 plus $3 s/h
Spectrum Projects
93-15 86th Drive
Woodhaven, NY 11421
212-441-2807

These chips upgrade the Color Computer to 64K RAM. Hitachi, Motorola, or NEC manufacture the RAM, which is either plastic or ceramic. A circuit board isn't included, and installation requires cutting traces or soldering on some versions of the Color Computer. Access time is 200 nanoseconds. Installation instructions and a 90-day warranty are included.

64K Memory
$48 for eight
Total Access
P.O. Box 790276
Dallas, TX 75379
214-458-1966

This product turns your computer into a 64K machine. The RAM is plastic or ceramic and does not have a circuit board; cutting traces or soldering is unnecessary. Access time is 200 nanoseconds. The chips are guaranteed for one year.

64K Memory Upgrade
$64.95
The Micro Works Inc.
P.O. Box 1110
Del Mar, CA 92014
619-942-2400

This upgrades your Color Computer to either 32K or 64K RAM. Various companies manufacture this plastic RAM. Access time is 150 nanoseconds. The upgrade doesn't have a circuit board, and installation doesn't require cutting traces. The 64K upgrade requires minimal soldering on some versions of the Color Computer. Installation instructions for the upgrade and a warranty for the integrated circuits are included.

64K RAM Chips
$96
Level IV Products
32429 Schoolcraft Road
Livonia, MI 48150
800-521-3305

OKI manufactures this ceramic RAM. The chips do not include a circuit board; cutting traces and soldering might be required, depending on your revision board. Access time is 200 nanoseconds. The upgrade is FLEX compatible. Internal upgrade instructions are included, but the chips aren't covered by a warranty.

Atomtronics RAM Expansion
$75 (RAM only)
$44.95 (Adapter card)
$54.95 (Wolfbug)
Atomic City Electronics
3195 Arizona Ave.
Alamos, NM 87544
505-662-3200

This product expands your computer to 64K. Motorola manufactures the plastic RAM. A circuit board for C & D boards is included ($44.95). Installation doesn't require cutting traces but does require soldering. Access time is 200 nanoseconds. The C & D series boards require an adapter card. The Wolfbug monitor allows use of 64K with 1.0 series ROMs. Installation instructions, a 30-day money-back guarantee, and a 90-day parts and labor warranty are included.

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SMITH CORONA

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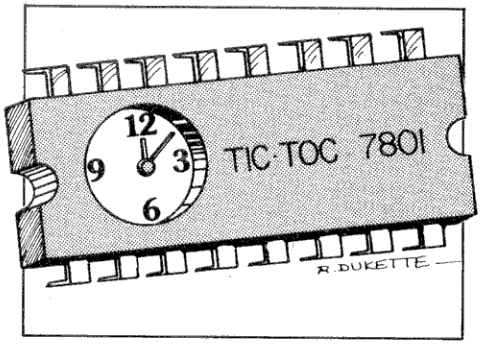
Grand Slam
$74.95
DSL Computer Products Inc.
P.O. Box 1113
Dearborn, MI 48121
313-582-8930

Grand Slam lets you upgrade from 16K RAM to 64K. The RAM is ceramic, and the product does not include a circuit board. You will have to cut some capacitors, but soldering isn't needed. You need an E or F board and a 1.1 ROM. Installation takes about a half hour. Access time is 150 nanoseconds. Installation instructions, diagrams, and a full one-year warranty are included.

RAM Slam
$49.95
DSL Computer Products Inc.
P.O. Box 1113
Dearborn, MI 48121
313-582-8930

This ceramic RAM lets you upgrade from 16K to 32K RAM. RAM Slam doesn't include a circuit board, and its installation doesn't require cutting traces or soldering. Installation instructions are included, and installation should be completed within 15 minutes. Access time is 150 nanoseconds. RAM Slam has a full one-year warranty.



Saddle Set
$39
$54 including color diagnostic tape
Computerware
4403 Manchester Ave., Suite 102
Encinitas, CA 92024
619-436-3512

Saddle Set lets you upgrade a 16K RAM Color Computer to 32K. Several manufacturers make the RAM, which is either plastic or ceramic. No circuit board is included, and installation doesn't require cutting traces or soldering. Access time is 200 nanoseconds. Installation instructions and a 90-day warranty are included.

Real-Time Clocks

BT-1020 Real Time Clock/Calendar
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Basic Technology
1500 Kent Road
Ortonville, MI 48462
313-627-6146

Installing this real-time clock doesn't require cutting traces or soldering; you just plug in the cartridge. It is fully user-software programmable, has a battery back-up, and is self-decoded with jumper-selectable address alternatives. It features the day, data, time, 100-year calendar, alarm interrupt, time interrupt, and 50 bytes of keep-alive RAM memory. It also compensates for daylight savings time and leap years. Basic and position-independent machine-language programs are included on tape but are also disk-loadable.

The user's manual includes operating and installation instructions, complete schematics, parts lists, and parts layout diagrams. A 180-day parts and labor warranty covers the product.

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$79.95 plus $3 s/h
Spectrum Projects
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Woodhaven, NY 11421
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The real-time clock uses the PIA port and has a battery back-up. It is accessible via software and includes date information. Although cutting traces isn't required, soldering is. Installation instructions are included, as well as a 90-day warranty.

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Disk Interface/ROM Pack Extender
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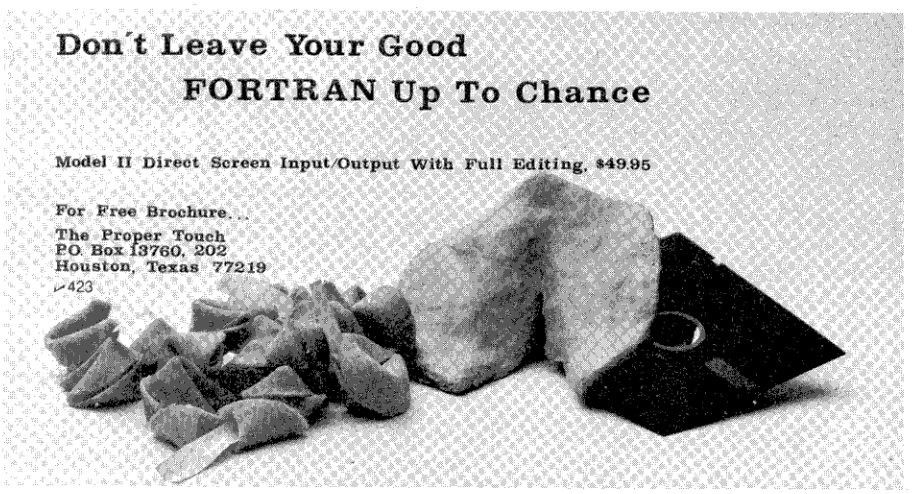
Spectrum Projects
93-15 86th Drive
Woodhaven, NY 11421
212-441-2807

Installing this extender doesn't require cutting traces or soldering. The product provides one port and has gold-plated connectors that prevent corrosion. The extender has a 90-day warranty.



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You become leader of a small and struggling country, attempting to stay alive, and expand if you can. Your government will have to deal with the many things every government runs in to; things like protecting your economy (or else risk a recession), providing services and food for your people, stimulating industry and encouraging new business, managing your government revenues, and controlling your army. From 1 to 4 players can take part if you have 16K of memory, or up to 9 players with more memory. If you don't have enough people around, you can assign any number of the countries for the computer to control. (The computer is a worthy opponent, and it plays by all the rules!) You won't quickly become tired of this program, since you will have to make very many decisions to become a successful ruler; you must ponder tax rates, food distribution, government services, large-scale loans, your army's status, your battles, and much more.
Included with the program is a 40 Page Handbook on how to rule a country successfully. (It is 8 1/2 by 11 inches, spiral bound; most business programs don't have a manual as good as ours!) The program is top-quality with excellent input and display routines.
The 16K and 32K versions are provided together on cassette; the 32K version contains a SAVE GAME feature. PRICE: **$18.50**
A 32K version (with SAVE GAME) is provided on diskette. PRICE: **$20.50**

For those of you with 48K: SUPREME RULER PLUS!

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We constantly examine and update our software offerings in order to make sure that they all live up to our current high standards of quality, and sometimes we remove a program from our line-up. This recently happened to our battle-simulation program, The BATTLE of ZEIGHTY. So now we have stopped producing it, but we still have a pile of them stocked up in our inventory. To get rid of them, we've cut the price IN HALF! (Previous purchasers have been compensated.) With this special offer there will be no warranty other than the Media Guarantee. (There will be no updates or returns.)
This is not to say that The BATTLE of ZEIGHTY isn't a good program; it is a well-made one player game. It allows you to set up a small army to your own specifications, and then you must use it to try to take over the fictional Zeighty Pass. You give each of your army divisions specific orders, while the computer plays the defending army. The display is satisfactory, consisting of a "Map" that shows the position of the army divisions. Land features (terrain) are not taken in to account, but you'll have enough to keep you busy. The program contains a wide set of commands and options (such as mines, artillery, 4 different division types, and more). It also has a built-in "HELP" function.
With a 20 page, full size manual; for 16K, Cassette - **$ 8.95**
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Syracuse, NY 13203
315-474-7856

This ROM pack port extender provides five extra ports. You don't have to cut traces or solder to install it. It has a 2K/4K EPROM socket with a 4K monitor EPROM. The monitor has a built-in FLEX boot, 64K memory access circuit, and a tracking power supply. The package doesn't contain cards. Installation instructions and a 90-day warranty are included.

The Spectrum Switcher
$99.95 plus $3 s/h
Spectrum Projects
93-15 86th Drive
Woodhaven, NY 11421
212-441-2807

The Switcher provides two ports and its installation doesn't require cutting traces or soldering. It lets you switch between a ROM pack and a disk controller without having to turn off or unplug the machine. The Switcher also lets you dump ROM packs to tape or disk with an auto-start switch. It comes with instructions and a 90-day warranty.

Y-PAK Dual Port Adapter
$70
TJN Systems
765 Rt. 83, Suite 111
Bensenville, IL 60106
312-860-5525

The Y-PAK doesn't require cutting traces or soldering. The dual-port adapter lets you select an automatic start feature in ROM cartridges. If the auto-start is turned off the cartridge is still readable. Documentation is included.

Serial-to-Parallel Converters

CCP-1 Serial to Parallel Printer Interface
$69
Botek Instruments
4949 Hampshire
Utica, MI 48087
313-739-2910

The CCP-1 doesn't require initializing software. It is Centronics compatible and can be configured as a 7-bit or 8-bit port. It has a switch-selectable baud rate from 300 to 9600, and all necessary cables are included. The converter comes with installation instructions and a one-year warranty.

Epson—Color Computer Interface
$49.95 plus $3 s/h
Spectrum Projects
93-15 86th Drive
Woodhaven, NY 11421
212-441-2807

This interface need not be software-initialized. It provides an 8-bit port and is Centronics compatible. It fits directly into the Epson MX-80 and FX-20 printers; it doesn't need a Radio Shack cable or an external power supply. Instructions and a 90-day warranty included.

PI80C Parallel Printer Interface
$69.95
The Micro Works Inc.
P.O. Box 1110
Del Mar, CA 92014
619-942-2400

The PI80C is Centronics compatible and doesn't have to be software-initialized. It can be configured as a 7-bit or 8-bit port. You must supply the printer cables. Instructions and a 90-day parts and labor warranty are included.

Serial to Parallel Converter
$69
Level IV Products
32429 Schoolcraft Road
Livonia, MI 48150
800-521-3305

This converter is Centronics compatible and provides an 8-bit port. It transmits data at up to 9600 baud. Up to 600 baud, you need do nothing as far as software is concerned. For 4800–9600 baud, you must do a quick Basic POKE that is included in the documentation. At 9600 baud, data is transmitted eight times faster than with an Epson printer alone. The converter comes with documentation and a 90-day warranty.

SPC-CC
$69 plus $4 s/h
Binary Devices
11560 Timberlake Lane
Noblesville, IN 46060
317-842-5020

SPC-CC is Centronics compatible and provides a 7-bit or an 8-bit port. You don't have to initialize it via software. Baud rates of 300, 600, 1200, 2400, or 4800 are available. Installation instructions, a 10-day money-back guarantee, and a 90-day warranty are included.

Miscellaneous

Analog Interface

CCAD Analog Interface
$169.50
Technical Hardware Inc.
P.O. Box 3609
Fullerton, CA 92634
714-870-1882

This interface is a 12-bit analog-to-digital converter that digitizes 16 different analog inputs, performs timed operations, controls three outputs, and formats data. It has two uncommitted pre-amplifiers, is user-friendly, and plugs into a user port. It has a real-time clock and an analysis frequency of 83 milliseconds to 16 hours. The interface includes a complete, documented software package for use as a data-logger system. Instructions and a 90-day replacement warranty are included.

Bubble Memory

Color Bubble
$600 (tentative)
Green Mountain Micro
Roxbury, VT 05669
802-485-6112

Due out soon, Color Bubble is a 1-megabit (128K byte) bubble memory system. It comes with the BOSS (Bubble Operating System Software), and fits inside the Color Computer's case. Average access time for a program or data is under ¼ second. Bubble storage is non-volatile—programs aren't lost when the power fails, and no battery back-up is required. It's removable and provides high security for sensitive data. Documentation and a six-month unconditional warranty are included.

Buffer

Smartbuffer
$335 and up
Data Match Corp.
3810 Oakcliff Ind. Court
Doraville, GA 30340
404-441-0408

The Smartbuffer is a print buffer/interface and a serial-to-parallel converter. It adds up to a 256K RAM to the computer (user upgradable to 128K; factory upgradable to 256K). It includes a circuit board, but its installation does not require cutting traces or soldering. Smartbuffer is a stand-alone unit with up to eight input/output ports.

As a serial-to-parallel converter, it is Centronics compatible and provides either a 7-bit or 8-bit port. You don't have to initialize it with software. It converts serial to parallel or vice versa and converts baud rates, protocols, character bit lengths, and stop bits.

Smartbuffer is also a temporary storage device for printers, plotters, and modems, and it buffers output or input data. Multiports let you connect several computers with several printers. Installation instructions, a six-month parts and labor warranty, and a two-year parts warranty cover the Smartbuffer.

Cassette Controller

Softrol Cassette Recorder—LSS-2
$19.99
Lemons Tech Services
P.O. Box 429
Buffalo, MO 65622
417-345-7643

Softrol is a solid state cassette motor controller. It provides fingertip control of the cassette and suppresses surges from switching that put hits on a taped program. Its one-second motor turn-off delay eliminates tape pinch by pulling the end of the program past pinch roller/capstan pressure. This delay puts a silent gap between programs on the tape, making program location easier.

Delay can be disabled if needed, such as for transmitter keying. You can use Softrol to switch any 5–10 volt dc load up to 1.5 amperes, either positive or negative ground. The unit uses no battery or line cord—it receives its power from the tape recorder. The product comes with a money-back guarantee.

Cassette System

TC-8C High-Speed Cassette System
$129.95
JPC Products Co.
12021 Paisano Court NE
Albuquerque, NM 87112
505-294-4623

The TC-8C is a two-port high-speed (3000 baud) cassette system that records and loads programs in half the time of the standard Color Computer system using the standard Radio Shack tape recorder. It has two independent software-selectable cassette ports. It has high data reliability, heavy-duty motor control relays, and a spare EPROM socket (2K or 4K). Instructions, a 30-day money-back guarantee, and a 90-day full warranty are included.

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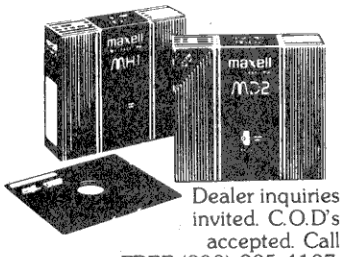

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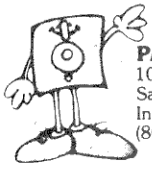

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Ilume Design
4653 Jeanne Mance St.
Montreal, Quebec H2V 4J5
Canada
514-843-3961

The Blackbox lets you transmit programs over telephone lines without a modem. Any Basic, machine-language, or data program can be transmitted from one Color Computer to another.

Expansion Interface Unit

BT-1000 Expansion Interface Unit
$270 plus s/h
Basic Technology
1500 Kent Road
Ortonville, MI 48462
313-627-6146

This parallel bus expansion unit plugs into the Color Computer's expansion unit. It features five expansion slots; a buffered plug-in cable; internal +5 volt, +12 volt, and −12 volt 16-watt power supply; internal memory decoding; and four 24-pin RAM/EPROM sockets. The user's manual includes operating and installation instructions, complete schematics, parts lists, and parts layout diagrams. The 180-day warranty covers parts and labor.

Extension Interface

Extension Interface
$79.95 plus $3 s/h
Spectrum Projects
93-15 86th Drive
Woodhaven, NY 11421
212-441-2807

The Extension Interface brings the Color Computer's rear jacks to a central control center. It has a printer/modem switch, LED, power indicator, and motor on/off control for the tape recorder. A 90-day warranty covers the interface.

Gold Plug

Gold Plug 80
$9.95 each/$54.95 for six
E.A.P. Co.
P.O. Box 14
Keller, TX 76248
817-498-4242

This gold plug eliminates contact problems with tin or lead card-edge connectors. Installation instructions are included. If you feel unqualified to install the plug, you can return it for a refund if unused.

Input/Output Port

I/O Port
$59.95
Green Mountain Micro
Roxbury, VT 05669
802-485-6112

The I/O Port is an 8-bit cartridge that interfaces the Color Computer to the real world. It can be used with ROM packs or the TRS-80 disk system; it comes with a three-foot cable and 3M style header connector. Documentation and an unconditional 90-day warranty are included.

Interface Port

BT-1030 Versatile Interface Port
$69.96 plus s/h
Basic Technology
1500 Kent Road
Ortonville, MI 48462
313-627-6146

This interface port is a fully self-decoded plug-in cartridge with provision for changing the address location. It is fully programmable, has two 8-bit parallel ports, four control lines, two 16-bit timer/counters, and a serial shift register. The user's manual contains operating and installation instructions, complete schematics, parts lists, and parts layout diagrams. A 180-day full parts and labor warranty is included.

Inverted Video

Inverted Video Upgrade
$32
Level IV Products
32429 Schoolcraft Road
Livonia, MI 48150
800-521-3305

Level IV Products installs this upgrade for you. The upgrade modifies the Color Computer so green characters appear on a black screen rather than vice versa. The work is covered by a 90-day warranty.

Morse Code Translator

Morse-Pak
$79.95
Atomic City Electronics
3195 Arizona Ave.
Los Alamos, NM 87544
505-662-3200

This Morse Code translator pack turns the Color Computer into a terminal for Morse Code communication. It allows code speeds up to 60 wpm and has .75 amp transmit relay. A parallel printer port is included. Instructions, a 30-day money-back guarantee, and a 90-day warranty come with the pack.

Multi-Function Product

ColorMate
$495
Computer Systems Distributors
P.O. Box 9769
Anaheim, CA 92802
714-772-1390

ColorMate has several functions. As a memory expander, it turns the Color Computer into a 64K RAM machine. Texas Instruments manufactures this plastic RAM. The product has a circuit board, but its installation doesn't require cutting traces or soldering. Access time is 350 nanoseconds. It has a transparent refresh and includes 2K RAM and simple memory diagnostic.

As a disk controller, ColorMate controls four 5¼-inch floppy or hard disk drives. It reads Radio Shack Color Computer disks and uses the SDOS operating system loaded from disk. The 1793 controller chip is used for the floppy drives; the hard drives use an intelligent controller. The capacity of a formatted 5¼-inch disk is approximately 100K. ColorMate has an optional 5M or larger Winchester disk drive. It uses Radio Shack's floppy disk drives and controller.

ColorMate is also a ROM pack port extender that plugs into the ROM pack port. Cutting traces or soldering is unnecessary. ColorMate provides one serial ACIA port and one parallel printer port or Winchester interface. As a parallel printer ROM pack, it provides an 8-bit port. It's Centronics compatible, and you don't need to initialize it with software.

Also a real-time clock, ColorMate does not have a battery back-up but is accessible through software. You can enter the date when booting up. Installation doesn't require cutting traces or soldering. It computes the exact time to 1/60th of a second, includes month, day, and year, and also handles midnight and leap years.

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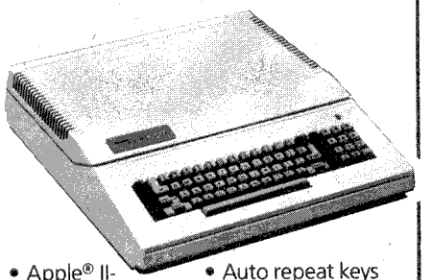

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212-441-2807

This external, 12-digit numeric keypad allows easier number entry. It plugs into the right joystick port and comes with a free machine-language driver. Instructions and a 90-day warranty are included.

Parallel Bus Expansion Unit

BT-2000 Companion
$249.95 plus s/h
Basic Technology
1500 Kent Road
Ortonville, MI 48462
313-627-6146

The BT-2000 is a switchable, parallel bus expansion unit that plugs into the Color Computer cartridge slot. It has five expansion slots, each of which is individually selectable by keyboard control, by program control, or by a push-button switch on the front of the unit. LEDs on the front panel tell you which slot is activated. Cold start reset gives you control of the computer from a locked-up condition without turning off the computer. The unit has a +5 volt power supply and a buffered plug-in cable. The user's manual has operating and installation instructions, complete schematics, parts lists, and parts layout diagrams. A 180-day full parts and labor warranty covers the product.

Prototyping Board and Enclosure

Proto-Pak
$34.95
Atomic City Electronics
3195 Arizona Ave.
Los Alamos, NM 87544
505-662-3200

Proto-Pak includes a four-inch by four-inch prototyping board and plastic box designed to fit into an expansion port. The board is epoxy glass. Each hole has a gold-plated pad and a ground plane. Circuit examples and installation instructions are included. A 30-day money-back guarantee and a 90-day parts and labor warranty cover the product.

Serial Line Analyzer

Serial Line Analyzer
$199
Control Craft Inc.
19270 North Hills Drive
Brookfield, WI 53005
414-784-9027

This product turns the Color Computer into a piece of test equipment. It plugs into the ROM pack port of the Color Computer and operates with all size memories. As an error-checker, it checks odd parity, even parity, no parity, framing error, data overrun, DCD high, and if the DCD changed since the last character. An instruction manual and a 90-day warranty are included.

Terminal Program Pack

Communication Pack
$69.95
Atomic City Electronics
3195 Arizona Ave.
Los Alamos, NM 87544
505-662-3200

The Communications Pack adds a 6850 ACIA serial port with terminal software in ROM. It lets you use a standard port to drive the printer while using the added port to communicate at up to 19.2K baud. It has a standard DB25 connector. Instructions, a 30-day money-back guarantee, and a 90-day parts and labor warranty are included.

Video Monitor Interface

Video Plus
$24.95
Computerware
4403 Manchester Ave., Suite 102
Encinitas, CA 92024
619-436-3512

Video Plus connects the Color Computer to a composite video monitor—color or monochrome. Video Plus lets you fine-tune for each monitor and computer, and it works with every motherboard revision. It does not disable the TV interface, so you can change from monitor to TV and back. An audio hook-up is available for monitors with sound. Installation requires no soldering, and instructions and a 90-day warranty are included. ■

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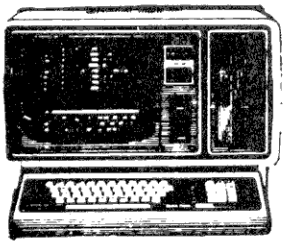

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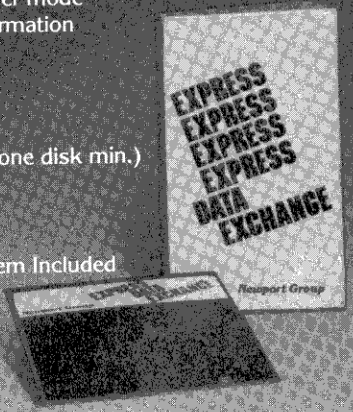

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Hardware Hacker Help

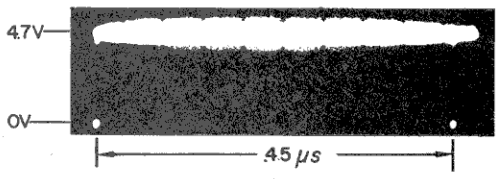
by Philip M. Van Praag

The author of the Hardware Hacker series returns to explain how to use test equipment to diagnose and repair digital logic circuits.

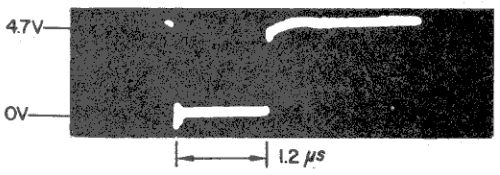
Figure 1

Printer Interface

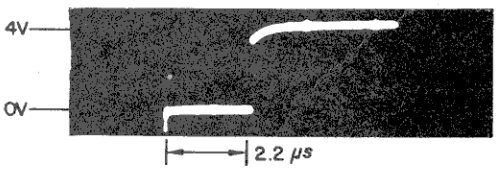
LOCATION: U2-11 (Printer status enable)
SCOPE: 2V/DIV, 50 μs/DIV
CONDITIONS: Printing any characters



LOCATION: U2-11 (Printer status enable)
SCOPE: 2V/DIV, .5 μs/DIV
CONDITIONS: Printing any characters



LOCATION: U6-6 (Strobe)
SCOPE: 2V/DIV, 1 μs/DIV
CONDITIONS: Printing any characters
REMARKS: Pulses occur every .45 ms.



LOCATION: U7-7 (D2 output data line)
SCOPE: 2V/DIV, 1 ms/DIV
CONDITIONS: Printing continuous FA character sequences

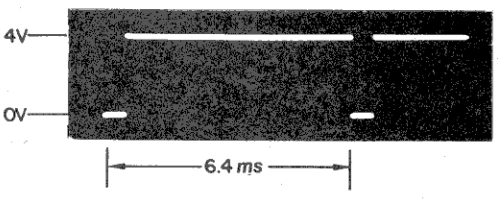


Figure 1 continues on p. 278

Building your own TRS-80 peripheral interface can be both utilitarian and fun. But once the project is completed, it may need repair. This article describes how to diagnose and repair digital logic circuits, the fundamental building block of most peripheral support interface (PSI) projects previously published (*80 Micro*, October 1982, p. 216; November 1982, p. 112; December 1982, p. 173; January 1983, p. 132).

This information should help you solve initial problems as well as those that develop after the PSI has been used for some time. In particular, the waveform patterns illustrated below may help you gain a better understanding of how the circuitry works.

Test Equipment Requirements

One advantage of working with digital logic circuits is their reliability and simplicity. Even if they fail, you can often repair digital circuits without sophisticated test equipment.

Table 1 contains a list of equipment that should satisfy any PSI service need. It contains some items that are not ordinarily considered test equipment, but are useful and often indispensable. Only the logic probe and the oscilloscope need further explanation.

You don't have to spend a lot of money on a logic probe. A $25 probe with a pulse stretcher, TTL (transistor-transistor logic) and CMOS (complementary metal oxide semiconductor) sensing, and guaranteed pulse detection of about 250 nanoseconds are adequate for most service needs.

An oscilloscope, by far the most expensive item, is valuable for design and knowledge-seeking endeavors. Al-

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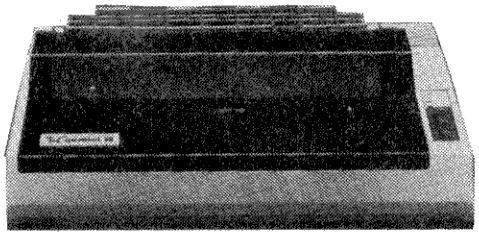

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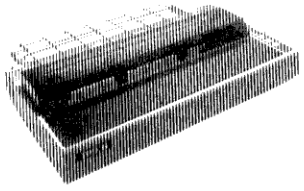

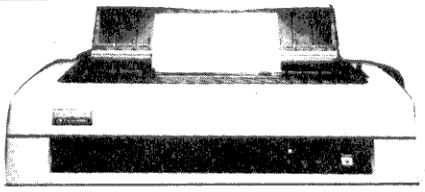

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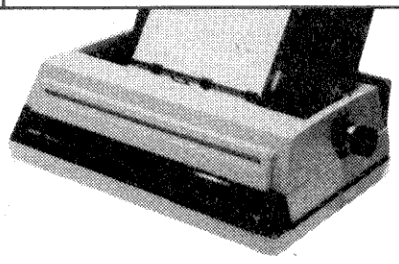

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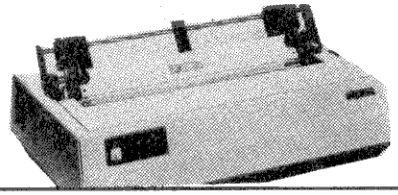

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- Miniature alligator-clip leads
- Logic probe
- Oscilloscope

Table 1. Recommended Test Equipment

Continued from p. 274

though highly desirable, it is not always required when the other equipment listed in Table 1 is available.

Don't give up your repair attempts just because you don't have access to a scope. Occasionally, there is no way to isolate a circuit fault without one, but most failures can be diagnosed without relying on a scope.

Digital voltmeters and logic pulsers (not listed) are niceties but, again, aren't required to service the PSI. A little ingenuity and some common sense should compensate for these two items.

Logical Failure Analysis

I want to present some fundamental concepts that streamline the troubleshooting process. First, reason out the problem. Start with a thorough list and analysis of the symptoms and compare it with the circuitry's expected performance. When you have a general idea of what part of the circuit might be at fault, use your magnifying glass and penlight to thoroughly inspect the area on both sides of the PC (printed-circuit) board.

Using the dental probe, slightly move wires and components, and inspect all solder connections and circuit traces. Even if the PSI worked flawlessly before, don't rule out a poor connection or a bridge across two circuit traces.

Next, measure and confirm dc (direct current) voltages in the area. Even if the voltages appear to be OK, look at the components for signs of overheating, and touch them to check for abnormally high temperatures. Be careful on the ½-watt resistors—they run very warm.

Then try dynamic testing. Use the logic probe (and the scope if you have one) to trace signals through the circuitry. Try to isolate the point deepest in the suspect circuit beyond which the signal disappears. Think about what the signals should be doing as you trace through the circuitry.

It is wise not to take measurements directly on the RAM or FDC (floppy disk controller) pins. Instead, attach the probe to the other end of the conductor path. Inadvertently shorting adjacent pins on these devices could be

Continues on p. 278

PC Board	Circuit Location	Voltage
Printer Interface	U1-4	2.65
	U1-1	.09
	U2-1	.09
	U3-11	3.27
	U4-3	4.47 or .13
	U5-6	2.37
	U6-4	.15
	U7-1	5.09
	U7-12	2.38
	U8-10	.12
Memory Addition	U17-10	1.73
	U18-1	2.97
	U18-3	5.09
	U18-11	5.09
	U19-3	1.91
	U19-6	.16
	U19-8	4.46
	U19-11	1.82
	U20-1	1.40
	U20-9	1.83
	U24-6	4.56
	U25-13	1.76
	U27-6	2.96
Power Supply—Memory Addition (Disk Controller Version in Parens)	U21-2 (None)	5.09
	U22-2 (U37-2)	− 4.46
	U22-3 (U37-3)	− 5.09
	U22-4 (U37-4)	−17.03
	U23-1 (U38-1)	18.09
	U23-2 (U38-2)	12.04
	X1-BASE (Same)	.00
	SCR1-GATE (Same)	.00
Disk Controller	U2-4	2.22
	U2-8	4.20
	U6-1	4.47
	U7-12	4.46
	U8-6	.12
	U13-13	5.03
	U14-15	4.45
	U15-15	.20
	U16-1	5.02
	U16-15	.00
	U20-2	.13
	U20-13	.12
	U21-13	.19
	U22-3	.30
	U24-4	.14
	U26-9	4.35
	U26-11	.13
	U27-2	.00
	U27-6	.00
	U27-8	.00
	U27-10	.00
	U27-12	.00
	U30-1	7.52
	U30-2	5.04
Piggyback Board	U32-2	.17
	U34-3	.19
	U34-8	4.39
	U34-11	.20
	U35-9	4.53

Table 2. Typical PSI dc Circuit Voltages

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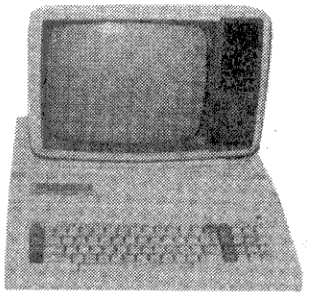

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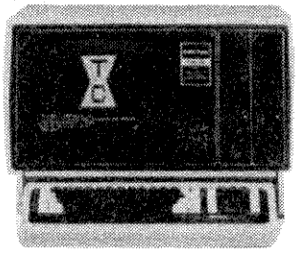

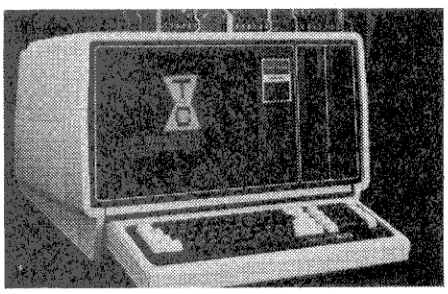

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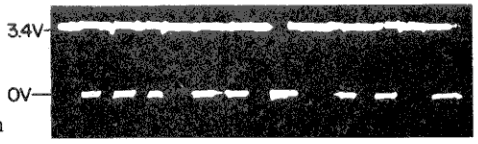
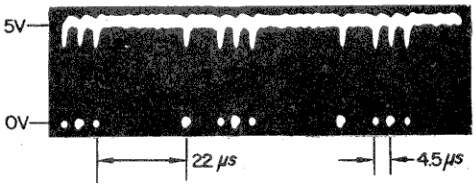
Figure 1 continued from p. 274

LOCATION: U8-13 (D4 input data line)
SCOPE: 2V/DIV, 2 μs/DIV
CONDITIONS: Printing continuous FA character sequences
REMARKS: Not much timing information can be determined from the data lines as they contain considerable noise and aperiodic pulses.

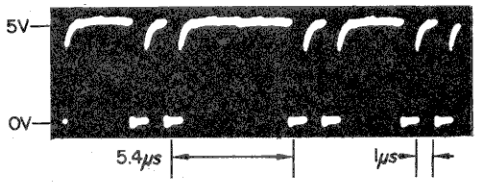


Memory Addition

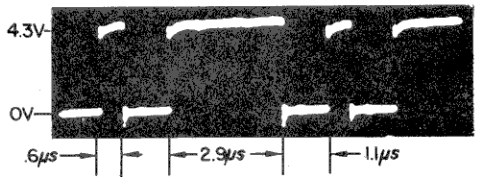
LOCATION: U18-3 (Lower RAM group CAS)
SCOPE: 2V/DIV, 10 μs/DIV
CONDITIONS: During the transition time following the first enter, when display reads "MEM SIZE?", and continuing until Ready
REMARKS: No pulses appear after Ready because now both A14 and A15 are active (as a result of recognizing the added 32K RAM).



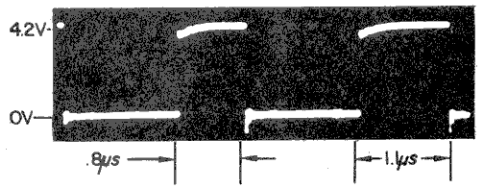
LOCATION: U18-11 (Upper RAM group CAS)
SCOPE: 2V/ DIV, 2 μs/DIV
CONDITIONS: After the first Ready appears on the display (after powerup and enter).



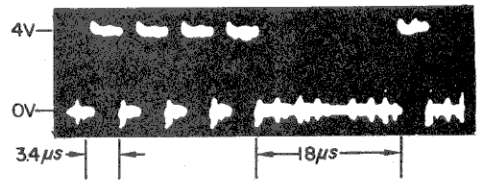
LOCATION: U19-8 (RAM read enable)
SCOPE: 2V/DIV, 1 μs/DIV
CONDITIONS: After the first Ready appears on the display (after powerup and enter)



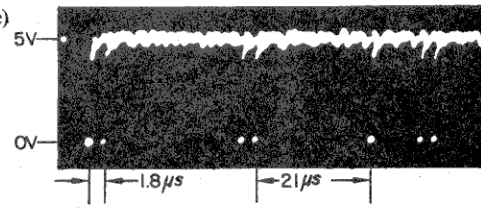
LOCATION: U19-11 (Inverted TRS-80 Read)
SCOPE: 2V/DIV, .5 μs/DIV
CONDITIONS: At "MEM SIZE?" display



LOCATION: U24-3 (A15)
SCOPE: 2V/DIV, 5 μs/DIV
CONDITIONS: After the first Ready appears on the display (after powerup and enter)



LOCATION: U25-11 (Buffered TRS-80 Write)
SCOPE: 2V/DIV, 5 μs/DIV
CONDITIONS: After the first Ready appears on the display (after powerup and enter)
REMARKS: Pulse duration = .6 μs



LOCATION: U27-6 (CAS)
SCOPE: 2V/DIV, .5 μs/DIV
CONDITIONS: After the first Ready appears on the display (after powerup and enter)

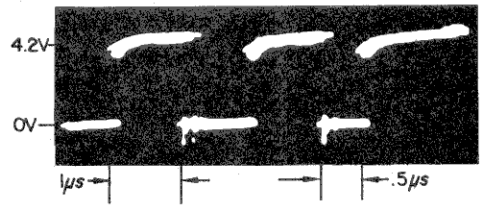


Figure 1 continues on p. 280

Continued from p. 276

disastrous.

If you still can't find the problem, start the analytical process over again beginning with a scan through portions of the PSI articles that deal with the problem area. You might stumble across some detail that triggers a solution.

". . . your voltage measurements might vary due to loading effects."

Notice that freeze spray and heat guns do not appear in Table 1. Ordinarily they should not be needed, and should not be used unless a thermal intermittent problem exists that cannot be diagnosed by other means. While these items are often effective, they can cause stress to many components, damaging them or causing failure. Use them as a last resort, and then sparingly.

Typical dc Circuit Voltages

Table 2 contains typical dc voltages at various circuit locations. These voltages are measured with a digital voltmeter having a 10-megohm input impedance. If you use a VOM (Volt-Ohm-Milliammeter), your voltage measurements might vary due to loading effects. Also, some variance is normal due to differences in component tolerance.

The circuit configuration for these measurements is as follows: The PSI is connected to the TRS-80, a printer, and a disk drive. The TRS-80 and PSI are turned on; the printer and disk drive are turned off. The TRS-80 is in its "Memory Size?" display mode.

Typical Waveforms

The following are typical waveforms as measured with a Tektronix model 2213 (60 megahertz) oscilloscope. As with the dc voltages, your measurements might vary somewhat.

Probe-loading characteristics, sweep-trigger designs or settings, and vertical-amplifier response can cause measurement variations with respect to amplitude, rise and fall times, and ringing. Also, the general appearance can vary due to overlaying aperiodic pulse repetitions.

The circuit configuration is the same as for the dc voltages, except that the printer and disk drive are turned on as needed. Special operating conditions are indicated for each measurement. ■

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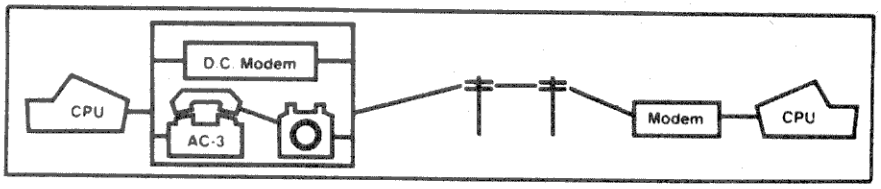

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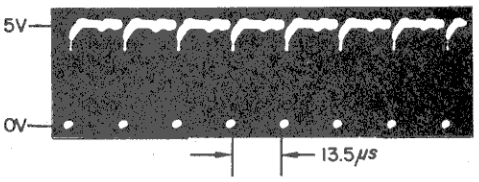
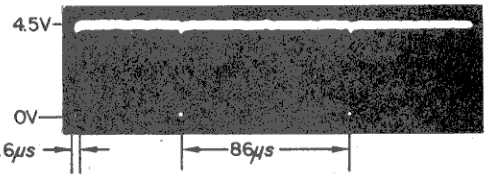
Figure 1 continued from p. 278

Disk Controller

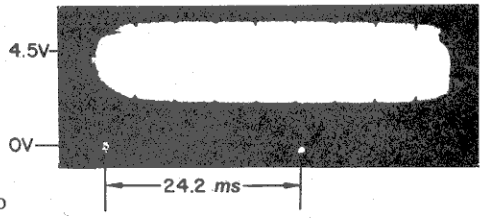
LOCATION: U7-8 (37ECRD)
SCOPE: 2V/DIV, 10 μs/DIV
CONDITIONS: Disk drive off; TRS-80 powerup without holding down break key
REMARKS: Scope shows +5Vdc (steady) if break key is held down at powerup. Pulse duration = 1.1 μs.



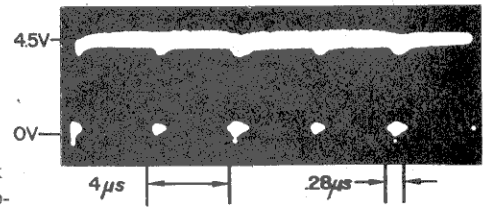
LOCATION: U7-12 (37EOWR)
SCOPE: 2V/DIV, 20 μs/DIV
CONDITIONS: During any disk read or write operation
REMARKS: Pulse repetition rate varies.



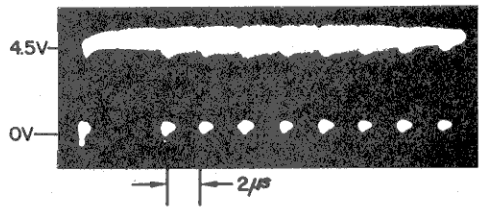
LOCATION: U14-15 (37EORD)
SCOPE: 2V/DIV, 5 ms/DIV
CONDITIONS: With Radio Shack's (cassette-form) "Real-Time Clock" utility running
REMARKS: Pulse duration = 1.1 μs. At powerup, U14-15 is at +4.5V dc (steady) whether or not break key was depressed. Also +4.5V dc after first Ready display.



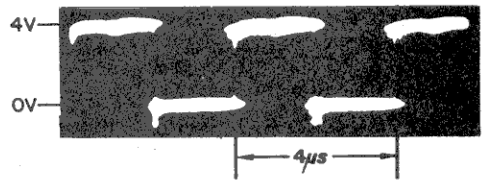
LOCATION: U20-4 (Raw Read)
SCOPE: 2V/DIV, 2 μs/DIV
CONDITIONS: During TRSDOS boot
REMARKS: In single density, bit cells are 8 μs wide. Horizontal pulse jitter is normal. What you see is an apparent series of alternating clock and data pulses. While the clock pulses do occur every 8 μs, data pulses are absent some of the time. Since the scope image is made up of many scans, however, it appears as if data pulses always occur between successive clock pulses.



LOCATION: U20-4 (Raw Read)
SCOPE: 2V/DIV, 2 μs/DIV
CONDITIONS: During DBLDOS boot
REMARKS: In double density, bit cells are 4 μs wide. Horizontal pulse jitter is normal. Note a 4 μs gap between the first and second pulse, also an apparent 2 μs gap between subsequent pulses. The 4 μs gap occurs since that is the minimum possible duration between any two pulses in MFM double-density mode. The apparent 2 μs gap thereafter occurs because of the many scans that make up a scope image, plus the fact that, in MFM, pulses might occur 6 μs apart. Thus, during some scans, the second pulse in the sweep occurs 6 μs after the start of the first pulse.



LOCATION: U21-9 (Read Clock)
SCOPE: 2V/DIV, 1 μs/DIV
CONDITIONS: During DBLDOS boot
REMARKS: Horizontal jitter is normal.



LOCATION: U22-3 (8 MHz)
SCOPE: .5V/DIV, 50 ns/DIV
CONDITIONS: Anytime PSI is on

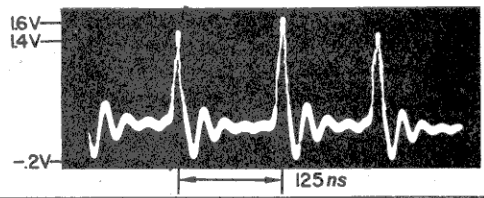


Figure 1 continues on p. 282

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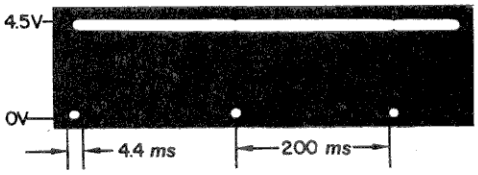
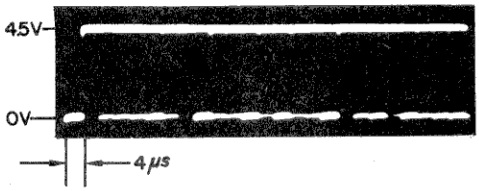
Figure 1 continued from p. 280

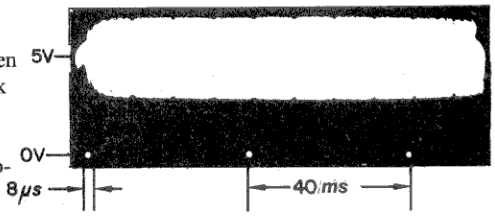
LOCATION: U24-10 (Index Pulse)
SCOPE: 2V/DIV, 50 ms/DIV
CONDITIONS: During any disk read or write operation



LOCATION: U26-4 (Late)
SCOPE: 2V/DIV, 10 μs/DIV
CONDITIONS: During double-density disk-write operation
REMARKS: Pulse repetition rate is erratic. Early (U26-6) should produce an identical waveform.



LOCATION: U27-6 (Step)
SCOPE: 2V/DIV, 10 ms/DIV
CONDITIONS: During TRSDOS boot, when head steps from track zero to directory track
REMARKS: TRSDOS was designed for the Shugart SA400 disk drive in the TRS-80 Model I. The SA400 calls for 40 ms track-to-track timing.



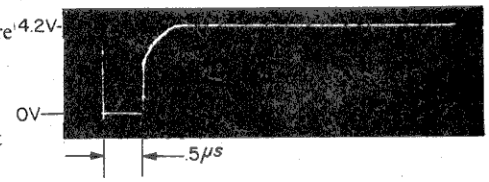
Miscellaneous Information:
LOCATION: U6-2 (Interrupt)
REMARKS: Should be at + .2V dc (steady) at TRS-80 powerup and after the first Ready display. With the clock utility running, U6-2 should look like U14-15, except +5V instead of +4.5V, and pulse duration is 44 μs instead of 1.1 μs.

LOCATION: U14-12 (Clock circuit output to D7 data line)
REMARKS: With the clock utility running, U14-12 should look like U14-15, except pulse duration is 44 μs.

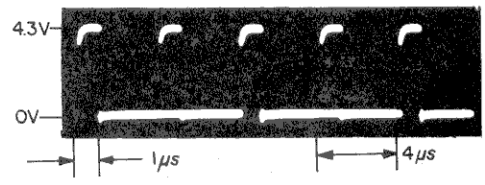
LOCATION: U14-14 (Interrupt Request)
REMARKS: Should be at +4V dc (steady) at TRS-80 powerup if break key is held down; then, approximately 10 seconds later (regardless of enter being hit), U14-14 goes low and stays there. If break is not held down at powerup, U14-14 is at +4V dc all the time.

Piggyback Board

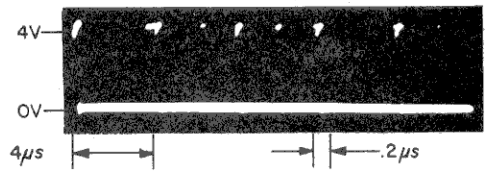
LOCATION: U34-8 (Double-density software trigger)
SCOPE: 2V/DIV, .5 μs/DIV
CONDITIONS: During DBLDOS boot
REMARKS: A single pulse occurs as a result of reading track zero on the disk.



LOCATION: U36-6 (Write Data)
SCOPE: 2V/DIV, 2 μs/DIV
CONDITIONS: Any single-density write operation
REMARKS: Same rules apply regarding pulse repetition as for read operation. Note the absence of horizontal jitter, as write precomp is not used for single density. Also note that the baseline extends through every other pulse. This indicates that some data intervals contain pulses, while others do not. Clock pulses, however, always occur at 4 μs intervals.



LOCATION: U36-6 (Write Data)
SCOPE: 2V/DIV, 2 μs/DIV
CONDITIONS: Any double-density write operation
REMARKS: Same rules apply regarding pulse repetition as for read operation. Horizontal jitter is normal, as a result of write precompensation.



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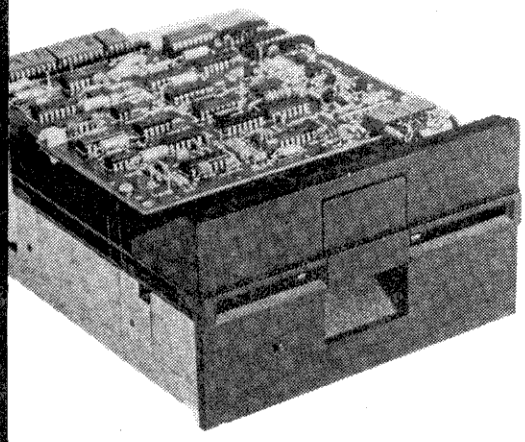

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Making a Weak Link Stronger

by Thomas Hartmann

If your TRS-80's screen is giving you a headache or making your eyes burn, try the tips presented here and solve the problem.

The screen is often the TRS-80's weakest link. Users complain of headaches, burning eyes, and difficulty focusing on the screen after a few hours of use. These problems are inherent in the design and type of monitor used by Radio Shack computers, but there are several possible solutions to the problems.

Eye Fatigue

The main causes of computer-monitor eye fatigue are flicker, glare, and poor contrast. The display device in most computer terminals (excluding LCD and gas-plasma displays, which are rare) is a cathode ray tube, or CRT.

The name comes from the electron beam generated around a heated metal cathode and directed and accelerated toward the screen's face by a series of focusing grids. The screen attracts the electron beam by a 10–15 kV charge applied to the tube's outside surface, called the anode.

This electron beam, traveling at near the speed of light, strikes the face of the screen, which has a phosphor-based coating applied to its inner surface. The impact of these particles causes the outer electrons of the phosphor molecules to be ripped off, making the phosphor glow. The color that the phosphor glows and how long the glow lasts are determined by the type of phosphor and what pigments and other chemicals are mixed with it.

Phosphor Types

In a TRS-80, the CRT screen glows a bluish white because it uses a standard black-and-white (or P-4) phosphor. The tube used in TRS-80s is the RCA 12VCLP4, a TV-grade CRT.

One reason so many people complain of eye fatigue with TRS-80s is the phosphor type used. The black-and-white P-4 phosphor Radio Shack uses has a decay, or fade out, time of .024ms or .000024th of a second. This means that as the electron beam sweeps the screen's face, the phosphor glows for .000024th of a second and then fades out, going black until the next scan (which occurs every .017 second).

The screen is black more often than it's white, rapidly strobing on and off (although it's difficult to detect the motion because the screen scans at the rate of 60 times a second, which is faster than the eye can catch).

The eye can detect these changes—on certain levels. Glance at a fluorescent light out of the corner of your eye sometime—it's strobing at 60 shots a second—and you'll be able to detect the strobe effect. Adelle Davis, the internationally known expert on health and nutrition, states that this flicker can burn up to 5,000 international units of vitamin A out of the retina of your eyes each day.

To see the flicker effect on your microcomputer, turn the brightness control up until the screen fills with a large square of white raster lines. Darken the room, and then wave your hand up and down in front of the screen.

Apple, IBM, and some other manufacturers have handled the flicker problem by using a slower-decay or more persistent phosphor in their CRTs. As the electron beam sweeps the screen, the phosphor glows and then fades at about .12 second—so when the beam comes around for the next scan the last dot of light is just fading out. The result is a display that glows, rather than strobes.

The drawback to this slower decay is a slight vapor trail left behind fast-moving characters on the screen. With fast-

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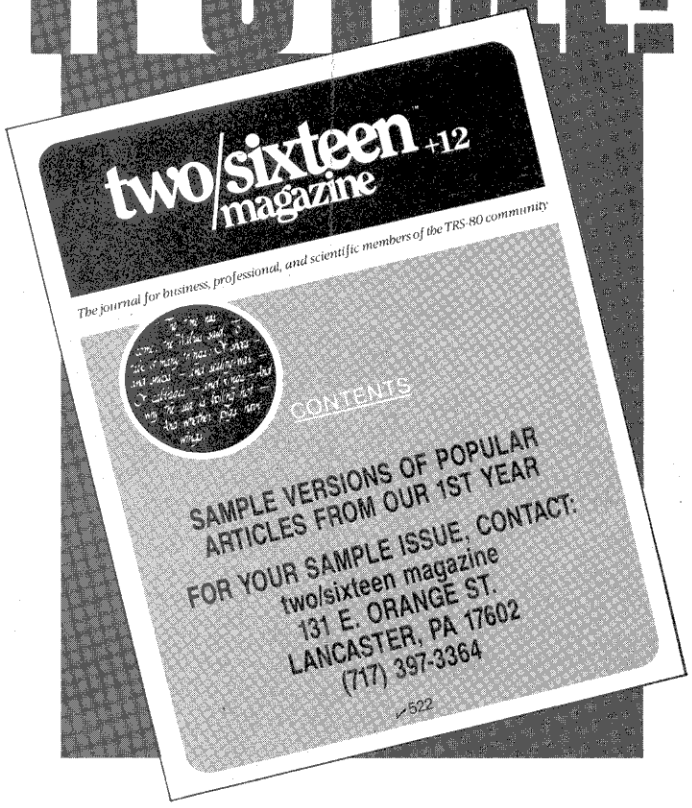

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action graphics or arcade games, you can see the phosphor fade out slowly. However, it's barely noticeable, doesn't interfere with the graphics, and is a small price to pay for the elimination of flicker—and 90 percent of your eye fatigue!

There's a difference between looking at a glowing screen and a flickering screen as anyone who's used one of these newer CRTs can attest. Some people find this slow-decay effect troublesome, and for them a faster phosphor, such as a P-34 amber or a P-31 green, might be better.

The slower-decay phosphors are a different color from the black-and-white variety, and are usually green or amber. Green is available in two different types: the P-31, which decays quickly and still presents the flicker problem; and the P-42, used by IBM and Apple, which decays more slowly. Langley-St. Clair Instrumentation Systems offers the P-42 as a replacement for Model I, II, and III CRTs.

In Europe, the standard is the amber, or European Orange (also known as LA Orange), phosphor. Because European Orange requires a rare-earth element, these monitors are generally more expensive.

The reason for using a colored phosphor has to do with the amount of light striking your eyes. White is the entire color spectrum, and is fairly intense. If you pick out a single color, such as green or yellow, you eliminate the other colors and reduce the intensity of light coming at you without reducing the visibility of the screen characters.

You get the best contrast ratio by placing yellow on black. An amber or yellow display produces the most visible characters for the least amount of total light emitted, making it easier for your eyes.

Eliminate the Glare

Glare is another problem for TRS-80 users. Glare is the ambient light of the room you're working in, reflected off the face of the screen. The easiest way to reduce glare is to simply move your terminal so that no light shines directly on the screen.

If it isn't possible to change the room lighting or move your computer you might consider a glare shield. Radio Shack makes a glare shield, a fine fabric mesh that affixes to the computer's outer frame. It eliminates a lot of glare, but some people complain that it has a negative effect on character resolution, or your ability to read the screen.

Polaroid sells a glare shield, which sells for over $100, that uses polarization of light to stop glare. This sheet of optically treated glass uses a slick set of optical tricks to make reflected light cancel itself out. It's quite effective, and also quite expensive.

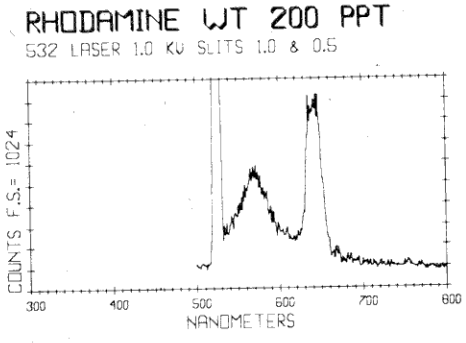
There are other fabric mesh products on the market that can help the glare problem in varying degrees. Some affix directly to the CRT's face (requiring disassembly of the microcomputer), and others mount on the frame.

Improving the Contrast

Contrast enhancement refers to improving the contrast and clarity of the characters on the screen. The three main mechanisms of contrast enhancement are adding darkening pigments to the phosphor to make a blacker field for the letters to stand out, darkening the glass on the front of the screen for the same reason, and improving the bandwidth of the video or character-generating electronics so the spots on the screen are sharper.

To improve the electronics of your TRS-80, you can try eliminating the 1,500-ohm resistor mounted on the CRT socket and in series with the cath-

EPSON GRAPHICS



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ode, or replacing it with a 100 μH peaking coil.

Some people have also reported good results with replacing the coax to the cathode with a piece of RG-58U, and adjusting the blue focus trimmer on the Model III video board. Be careful, though; this is an area where the power can exceed 14,000 volts.

To improve the electronics of character generation on the Model I or III you can buy one of the hi-res graphics kits, such as Mikeegraphic. The Model II video electronics are much better (considering the TV-grade CRT that comes with it), and come pretty close to high-res graphics. But that's not much consolation to a Model I owner.

X-Rays and CRTs

CRTs produce some X-rays, although the government has set standards designed to protect the public.

The standards for exposure by office workers are the same as the standards for clean-up crews in disabled nuclear reactors: 5 rads (or 5,000 millirads) per year. A standard chest X-ray is about 30 millirads, so this standard is equivalent to over 160 chest X-rays annually.

While there are no specific standards for X-ray emissions from computer monitors, the FDA applies the old black-and-white TV CRT emission standards to computer terminals. This standard calls for X-radiation, measured at a distance of 6 cm (about 3 inches) from the screen, to not exceed .5 millirad per hour.

Since X-rays are cumulative, that equals a chest X-ray about every 60 hours you're in front of the screen (measured at 3 inches; radiation decays as you move away from the screen).

"This standard is equivalent to over 160 chest X-rays annually."

This standard was fine for black-and-white TVs, which are usually viewed at a distance of 6–10 feet, but office workers' unions and groups have expressed concerns that the standards aren't appropriate for computer terminals. The FDA recently found that eight of 87 terminals tested exceeded this liberal standard (one by more than 2½ times).

Color Versus Black and White

Color monitors are worse than monochrome (single-color) monitors because they operate at much higher voltages. X-ray emission is a direct and linear function of voltage, and some color CRTs operate at up to 35,000 volts. Until recently, Federal standards for X-ray emission from color monitors equaled 2.5 millirads per hour, or a chest X-ray about every 12 hours, again measured at 6 cm from the screen. They are now set at black-and-white levels.

TRS-80s operate at fairly low voltages, and the CRT's manufacturer used a slightly leaded glass to reduce X-radiation. Their own documentation indicates that, at normal operating voltages and current, the X-radiation will never exceed the federal standards for black-and-white TVs (.5 millirad/hr), and tests done on similar CRTs were unable to detect any X-rays at all when configured similarly to the TRS-80. Leaded acrylic X-ray shields are available for color monitors.

The TRS-80 is one of the best microcomputer buys around, and with a glare shield, contrast enhancement filter, or replacement CRT, the weakest link in the man-computer interface can be made stronger. ■

Thom Hartmann can be reached at 5 Garland St., Plymouth, NH 03264.

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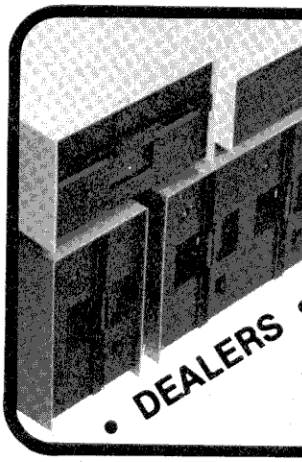

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Profile File Transfer

by John Mabry

If you need to transfer Profile data to new files, you can use this easy Basic program.

Profile is one of the best-known database management packages for the Model III. Although the original Profile has many useful features, you cannot transfer old Profile data into a new file. For example, say you have a Profile data base of library holdings and decide you need a new field. The simplest way to do this is to create a new template for the data base, transfer all the current data into the new file, and add the new field information later. Profile doesn't allow this, however; you cannot transfer data from an old template to a new one. Instead, you have to type in the new field information for each Profile record.

The program presented here, XFER/PRO, lets you transfer Profile data using a two-disk Model III system. It is written in Basic and uses Profile's Basic access routines to invoke Infofile as a subroutine.

To use XFER/PRO, first create new Profile disks containing the new field. Interchange the drive-zero disk and the drive-1 disk. The program provides little protection against mistakes such as inserting the wrong disk in the wrong drive or inadvertently overwriting old files. In fact, you should make the transfer using back-up copies of the old files with a second copy of the new files handy.

To make a transfer, call up Basic at "TRSDOS READY". Then answer the "How many files?" question with 2V, 3V, or 4V, as appropriate. Press enter again for memory size and type RUN "XFER/PRO".

At the prompt, remove the Basic disk and insert both old Profile disks into the proper drives. Press enter to access Infofile (line 160). The same line passes the subroutine values to new variable names. Line 166 prints the field names and the size or length of each field to your screen. Insert the "new" Profile disk (zero disk only) and repeat the process of accessing Infofile for that disk. The new field names and field lengths appear below those of the old file.

If fields or their names are unusually long, both might not fit on the same screen. You should make careful note of the field names, numbers, and lengths to be transferred in case this does happen. The new field length should be at least as long as the old field to be transferred. It is not necessary that they have the same name.

The program (lines 225–260) steps through each of the old disks' fields and asks for a corresponding field to transfer to on the new disk(s). Enter zero and no transfer occurs from that source field (line 240). This lets you skip over fields of no interest.

The same source field reappears if you attempt to transfer a larger field to a smaller one or to a nonexistent field. If you enter the wrong number, break and GOTO (not run) line 210 in the command mode. The program prompts for this but provides no editing facility.

Once you make your choices, the program asks you to put the old disk in drive zero (drive 1 still has its disk). After you press enter, the program stores the first field to be transferred into array A1$(i). The variable W counts the old, to-be-transferred fields and the J(W) array that holds the corresponding numbers of the receiving fields.

The variable G counts the number of passes in case memory cannot store all the records of the selected field at once. The program will not transfer fields deleted by Profile on the original disk (line 370).

After a completed gulp, the program prompts you to insert the new (destination) disks.

From this point on, the entire process is automatic except for inserting the Profile disk(s) and pressing enter when prompted.

When the program transfers all files requested, it reopens "Infofile" on disk zero of the destination file (line 700) and records the total number of records transferred. This should equal the variable N minus RD. If you do not want this feature, you can disable it or use it from the command mode after redesignating the two variables (e.g., N=400: RD=0: GOTO 700).

This program is intended to be a utility program that facilitates the transfer of file contents to new fields. It accommodates up to four drives, but I tested it on only two, and all user prompts as-

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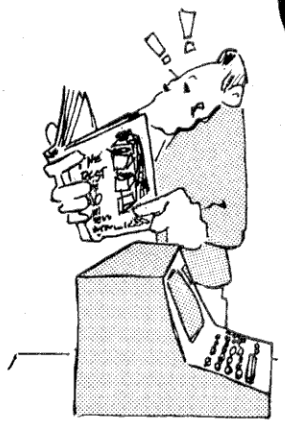

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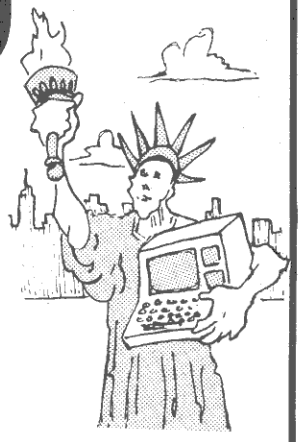

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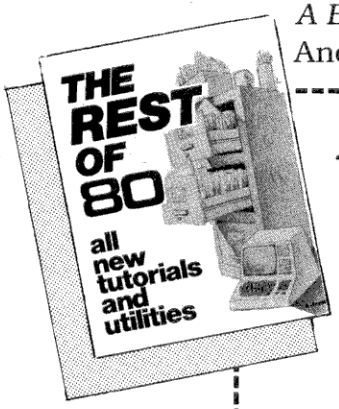

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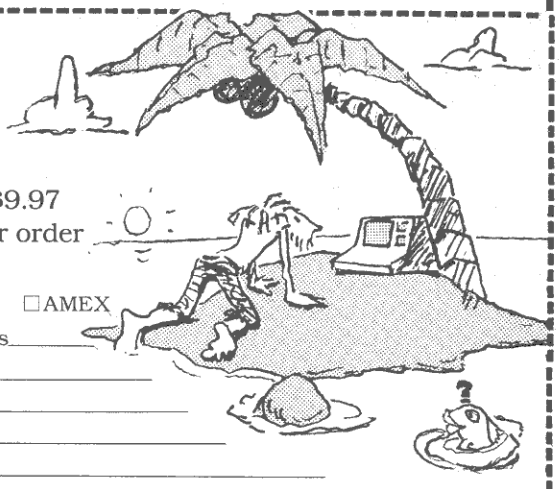

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sume two drives. This transfer program should also work on the Model I Profile, but again, I didn't test it.

Lines 100 and 110 keep the number of disk swaps low. Line 100 clears 19000 for string space. You might increase the string space for other 48K machines. You would certainly have to decrease it for 32K machines. However, the string space was not optimized for this machine. It seemed like a good approximation after several "PRINT MEM" commands showing just over 22K left after loading and collecting variables.

Line 110 defines the value of X that holds the key to how many records the program accommodates in a single pass. I left this to the end of line 110 to help make changes easy between machines. If you can increase the string space cleared in line 100, you can also increase the value of X. If you add more programs or use a 32K machine, you must decrease the value of X along with the string space cleared in line 100.

Other than the value of X, the number of swaps necessary depends on the total number of fields in the source record and the length of each field. Some fields take only one pass (one swap), while others require several.

"The program provides little protection against mistakes such as inserting the wrong disk or inadvertently overwriting old files."

Nothing in the program prevents mistaken disk placement. I made an attempt to circumvent the return to TRSDOS if a nonsystem disk is placed in drive zero by including ON ERROR GOTO at critical points (see lines 7000–7030), but this works only occasionally.

At other times the machine displays a double-size screen format and a cryptic message. If this occurs, the break key restores the program about half the time. The simplest solution is to keep your disks straight with good labeling.

I wrote the current program on the newer version of TRSDOS. The operating system on early Profiles is an earlier version. If you have not changed to the newer DOS, the current program might have some unanticipated bugs. More important, whatever version of TRSDOS your Profile has, the Basic program must be on the same. ■

Program Listing

```
5 '
10 '              ' X F E R / P R O '
       a file transfer program for PROFILE
                ( MODELS I  & III )
20 '          By John H. Mabry, Ph.D.
                Psychology Department
                 MURDOCH CENTER
30 '             Butner, N.C. 27509


40 '


90 PRINT" ** PLEASE NOTE **
When entering BASIC you need to specify the number of files
equal or greater than the number of drives (example: 2V ).
This program requires the V postfix as well."
95 PRINT " If you have not done this press the BREAK key, type
 CMD";CHR$(34);"S";CHR$(34);" to reenter TRSDOS then BASIC to an
swer the 'number of files' question.  OTHERWISE YOU MAY CONTINUE
 THIS PROGRAM HERE BY PRESSING <ENTER>.":INPUTAN$
100 CLEAR19000:CLS
110 DEFINTA-W:DIMD(4),NM$(32),CU(32),LN(32),F$(32),FD(4),NA$(32)
,CW(32),LE(32):X=17000
150 INPUT"INSERT SOURCE DISKS IN PROPER DRIVES AND PRESS <ENTER>
   ";AN$:CLS:ONERRORGOTO7000:OPEN"I",1,"INFOFILE"
155 ONERRORGOTO0:CLOSE
160 GOSUB6000:N=NR:MY=MX:DM=MD:RD=DR:LR=RL:F=NF:FORI=1TO4:FD(I)=
D(I):NEXTI:FORI=1TOF:NA$(I)=NM$(I):CW(I)=CU(I):LE(I)=LN(I):IN=IN
STR(NA$(I)," "):NA$(I)=LEFT$(NA$(I),IN-1)
166 PRINT@(I-1)*32,USING"##";I;:PRINT". ";NA$(I);" (";LE(I);")";
:NEXTI:CL=(I-1)*32:CL=INT(CL/64)*64:CL=CL+64
167 PRINT@832,"YOU DID WELL ";
170 PRINT@845,"-";:INPUT"  NOW INSERT DESTINATION DISK (DRIVE 0
ONLY)        & <EN> ";AN$:PRINTCHR$(27);CHR$(27);CHR$(31);:ONERR
ORGOTO7010:OPEN"I",1,"INFOFILE"
175 ONERRORGOTO0:CLOSE:PRINT@768,STRING$(32," ");
180 GOSUB6000
200 FORK=1TONF:IN=INSTR(NM$(K)," "):NM$(K)=LEFT$(NM$(K),IN-1):PR
INT@CL+(K-1)*32,USING"##";K;:PRINT". ";NM$(K);" (";LN(K);") ";:N
EXTK:PRINT@719,"( ) = Field length ";
210 PRINT@768,"Indicate by number the DESTINATION (new) FIELD to
 recieve each  SOURCE (old) FIELD:  '0' =  NO transfer. ";
225 FORK=1TOF:J(K)=0
230 PRINT@896," FIELD #";:PRINTUSING"##";K;:PRINT" ( ";NA$(K);":
 ) ON SOURCE, TO DEST. FIELD # ";:INPUTJ(K):PRINTCHR$(27);CHR$(3
1);
240 IFJ(K)=0THENNEXTK:GOTO270
250 IFJ(K)>NFORLN(J(K))<LE(K)THENGOTO230
260 NEXTK
270 CLS:INPUT" PRESS <EN> TO CONTINUE ELSE <BREAK> AND 'GOTO' 21
0 TO RE-EDIT   FIELDS ";AN$
300 CLS:M=0:FORI=1TOF:LD(I)=M:M=M+LE(I):IFJ(I)=0THENNEXTELSE:Q=0
:FORK=1TOJ(I):DL(J(I))=Q:Q=Q+LN(K):NEXTK:NEXTI
305 DIMA1$(N):CLS:FORW=1TOF:IFJ(W)=0THENNEXTW:GOTO700:ELSEIX=1
307 V=INT(X/LE(W)):IFV>=NTHENA=N:B=1:ELSEB=INT(N/V)+1:A=V:IFA>NT
HENA=N
308 ID=1:DN=1
309 FORG=1TOB:PRINT@0," PASS # ";G
310 INPUT"     INSERT BOTH SOURCE DISKS (OLD PROFILE REC.'S) AND
 <EN> ";AN$:MR=0:ONERRORGOTO7020:OPEN"I",1,"INFOFILE"
311 ONERRORGOTO0:CLOSE
312 FOR I = 1 TO DM + 1
314   OPEN "R",I,"PRODAT:"+CHR$(47+I),LR
317 NEXT I : FIELD 1, LD(W) AS DUMMY$, LE(W) AS A$:FIELD 1, LE(1
) AS CHECK$
320 PRINT@512,CHR$(27);CHR$(29);CHR$(31);" GETTING FIELD ";:PRIN
TUSING"##";W;:PRINT" FOR TRANSFER TO FIELD ";J(W);
330 PRINT@576,"GETTING RECORD # ";
340 FORRN=IDTO(ID+A)-1:PRINT@592,USING"####";RN;
350 IFRN>FD(DN)THENDN=DN+1:FIELD DN, LD(W) AS DUMMY$, LE(W) AS A
$:FIELD DN, LE(1) AS CHECK$:NN=RN-FD(DN-1):GOTO350: ELSE NN = RN
370 GETDN,NN : IF ASC(CHECK$)=192 THEN NEXT RN:GOTO 410
390 MR=MR+1:A1$(MR)=A$
400 NEXTRN
410 ID=RN:IFN-ID<ATHENA=(N-ID)+1
420 CLOSE:PRINT:PRINT"INSERT DESTINATION DISKS (NEW) AND <EN> ";
:INPUTAN$:PRINTCHR$(27);CHR$(29);CHR$(30);:ONERRORGOTO7030:OPEN"
I",1,"INFOFILE"
430 ONERRORGOTO0:CLOSE
```

Listing continues

John Mabry can be reached at the Murdock Center, Butner, NC 27509.

Listing continued

```
 470 FORI=1TOMD+1
 480 OPEN"R",I,"PRODAT:"+CHR$(47+I),RL:NEXTI
 490 FIELD 1, DL(J(W)) AS DUMMY$, LN(J(W)) AS B$
 500 DN=1:RM=0:PRINT@576,"PUTTING RECORD # ";
 510 FORRN=IXTO(IX+MR)-1:RM=RM+1
 520 IFRN>D(DN)THENDN=DN+1:FIELD DN, DL(J(W)) AS DUMMY$, LN(J(W))
AS B$:NN=RN-D(DN-1):GOTO520:ELSE NN=RN
 530 GETDN,NN
 550 LSETB$=A1$(RM)
 560 PUTDN,NN:A1$(RM)="":PRINT@592,USING"####";RN;
 570 NEXTRN:CLOSE:MR=0
 580 IX=RN
 590 NEXTG
 600 NEXTW
 700 CLS:CLOSE:OPEN"R",1,"INFOFILE",128
 710 FIELD 1, 2 AS NR$ :GET1,1
 720 LSETNR$=MKI$(N-RD):PUT1,1
 730 CLOSE:PRINT" TRANSFER COMPLETE- CHECK RESULTS BY ENTERING TR
SDOS AND RUN PROFILE":END
4999 END
6000 REM
6010 OPEN"R",1,"INFOFILE",128
6020 FIELD 1,2 AS NR$,2 AS MX$,1 AS MD$, 2 AS DR$, 1 AS RL$,1 AS
 NF$,2 AS D$(1),2 AS D$(2),2 AS D$(3),2 AS D$(4)
6030 GET1,1
6040 NR=CVI(NR$):MX=CVI(MX$):MD=ASC(MD$)
6050 DR=CVI(DR$):RL=ASC(RL$):NF=ASC(NF$)
6060 FORI=1TO4:D(I)=CVI(D$(I))+1:NEXTI
6070 FORI=0TO3:GET1,I+3
6080 FORJ=0TO7:K=I*8+J+1
6090 FIELD 1,(J*16)AS D$,13 AS N$, 2 AS CU$,1 AS L$
6100 NM$(K)=N$:CU(K)=CVI(CU$):LN(K)=ASC(L$)
6110 NEXTJ,I:CLOSE:RETURN
7000 PRINTCHR$(27);CHR$(29);" * IMPROPER DISK IN DRIVE '0' * ";:
CLOSE:RESUME150
7010 PRINTCHR$(27);CHR$(29);" * IMPROPER DISK IN DRIVE '0' * ";:
CLOSE:RESUME170
7020 PRINTCHR$(27);CHR$(29);" * IMPROPER DISK IN DRIVE '0' * ";:
CLOSE:RESUME 310
7030 PRINTCHR$(27);CHR$(29);" * IMPROPER DISK IN DRIVE '0' * ";:
CLOSE:RESUME 420
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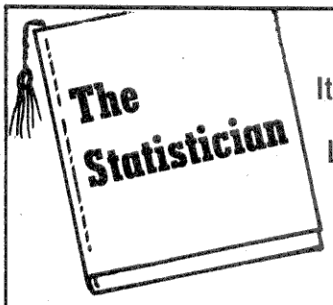

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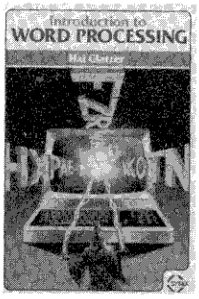

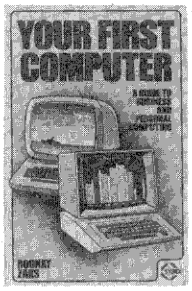

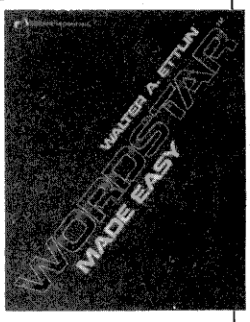

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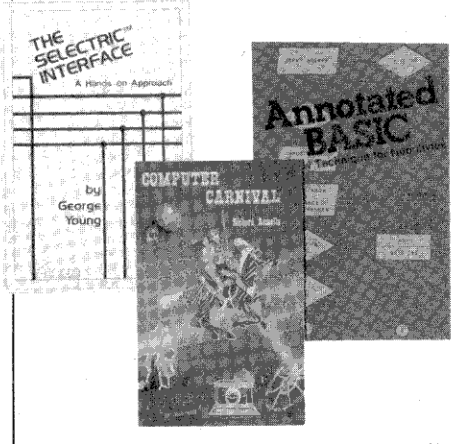

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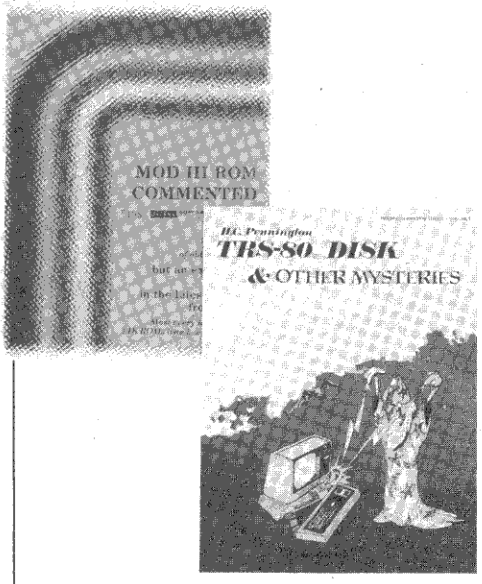

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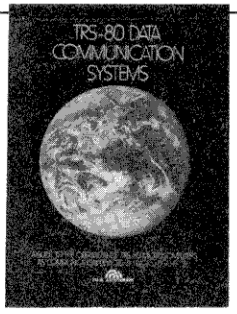

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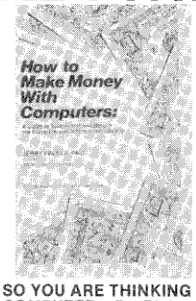

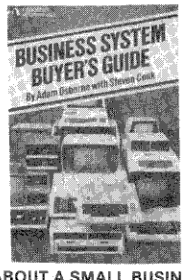

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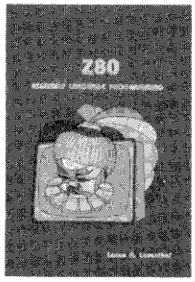

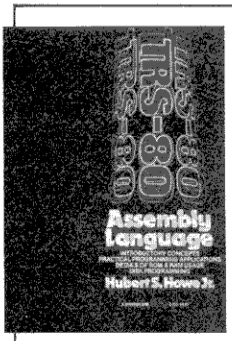

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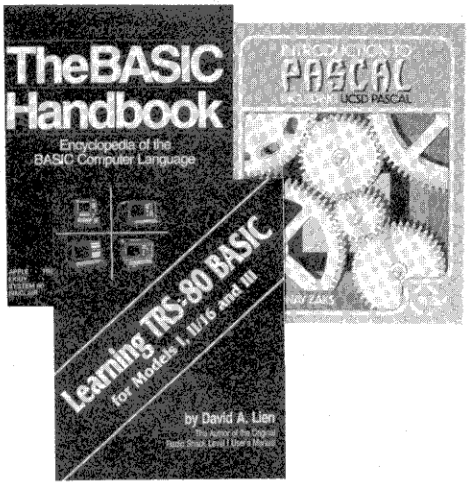

BASIC & PASCAL

LEARNING TRS-80 BASIC—by David A. Lien. Dr. Lien, who is the author of THE BASIC HANDBOOK and the original Radio Shack LEVEL I USER'S MANUAL, has compiled a tutorial which includes portions of the original USER'S MANUAL, and most of LEARNING LEVEL II along with extensive additions. It will completely cover the TRS-80 Models I, II, III, and 16 (sorry, not the color or pocket computers). It is, of course, written in the easy learning style which readers of Dr. Lien's books have come to enjoy. BK1175 $19.95.

THE BASIC HANDBOOK—SECOND EDITION—by David Lien. This book is unique. It is a virtual ENCYCLOPEDIA of BASIC. While not favoring one computer over another, it explains over 250 BASIC words, how to use them and alternate strategies. If a computer does not possess the capabilities of a needed or specified word, there are often ways to accomplish the same function by using another word or combination of words. That's where the HANDBOOK comes in. It helps you get the most from your computer, be it a "bottom-of-the-line" micro or an oversized monster. BK1174 $19.95.*

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Directory of Hardware Manufacturers and Distributors

It's difficult to keep track of all the products now available for Radio Shack computers. *80 Micro* has compiled a list of manufacturers and distributors of TRS-80-compatible hardware and software. The first half of the directory, covering hardware only, is below. The software directory will appear in a forthcoming issue. Manufacturers are listed first, followed by distributors (in alphabetical order).

Note: Only those companies that responded to the directory questionnaire are included.

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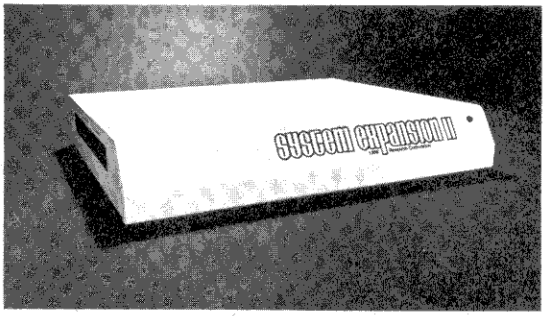

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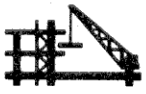

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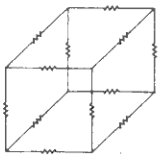

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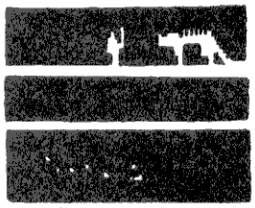

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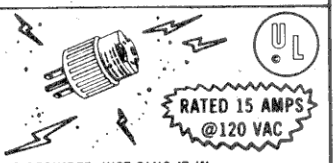

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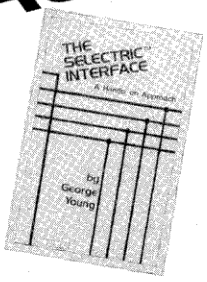

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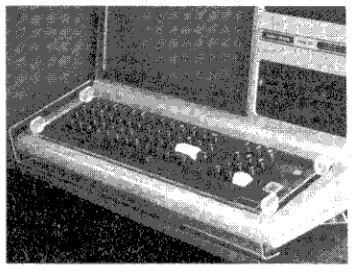

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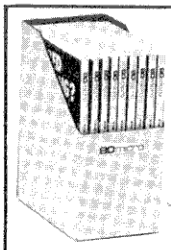

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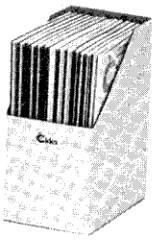

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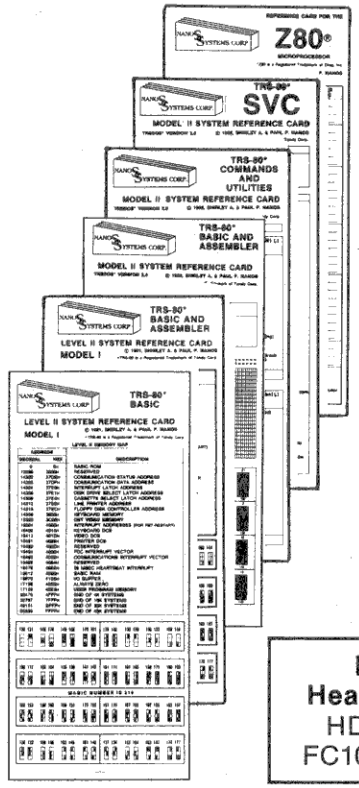

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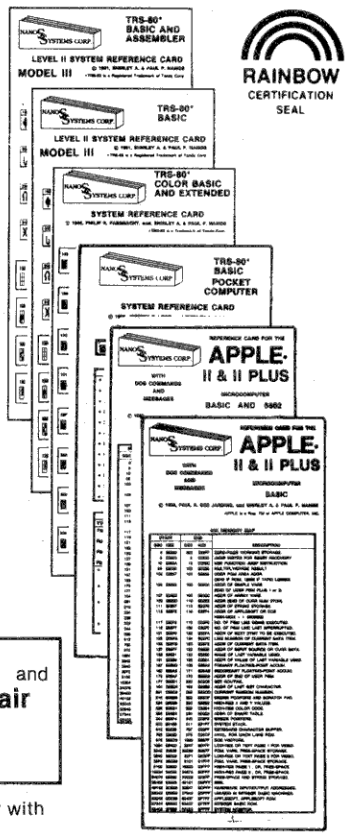

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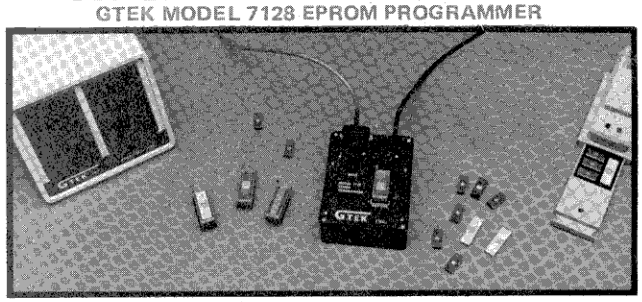

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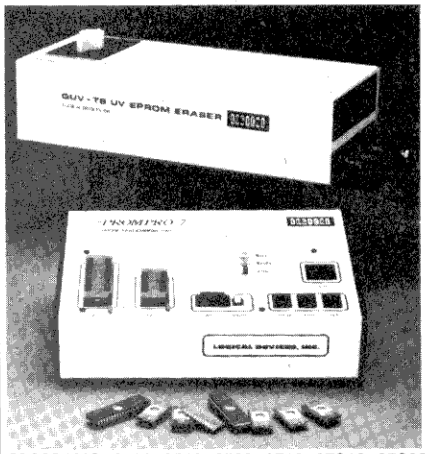

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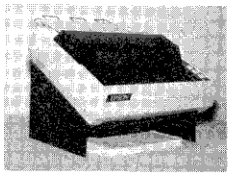

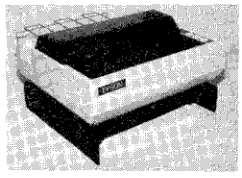

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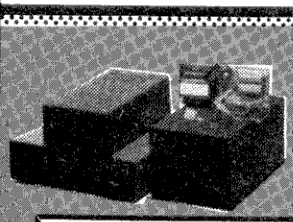

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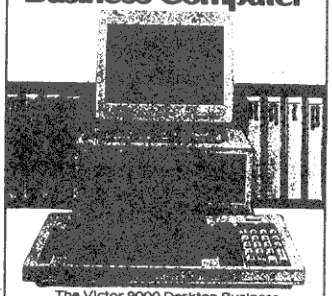

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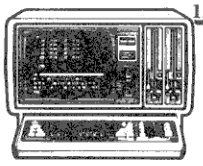

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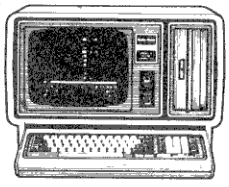
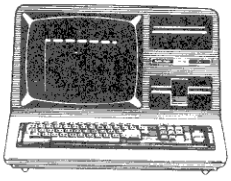


80K Model 12 CALL



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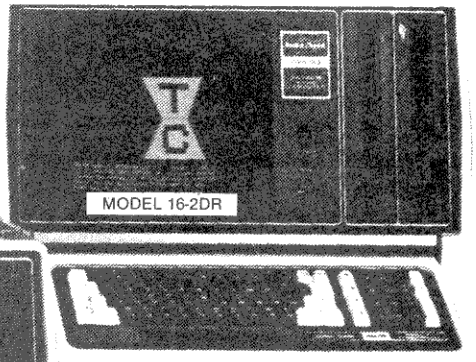

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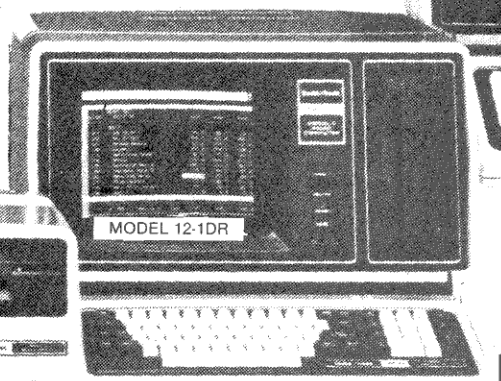

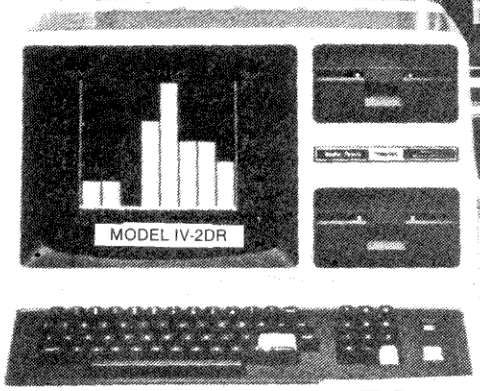

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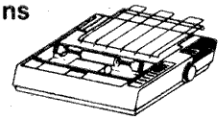

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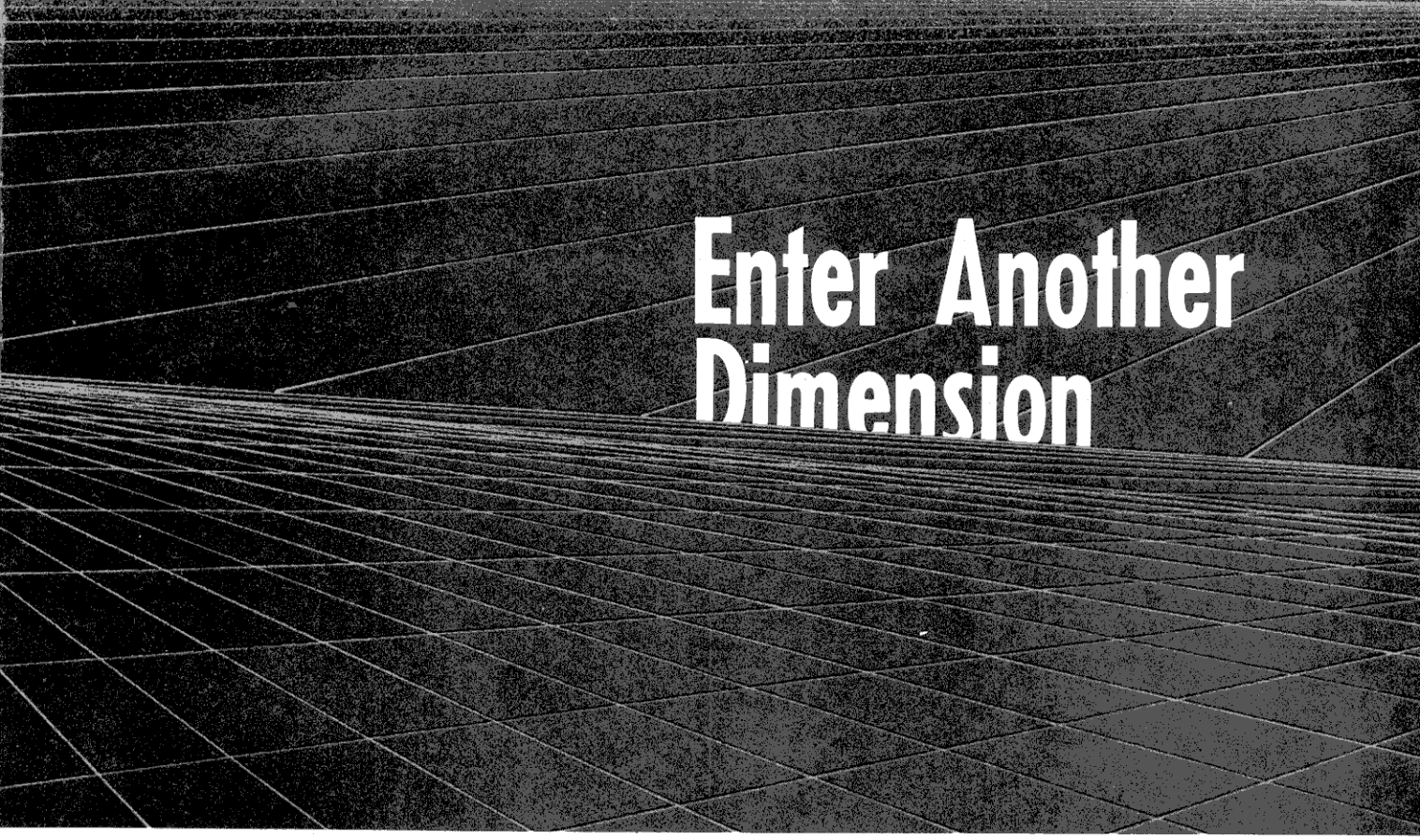

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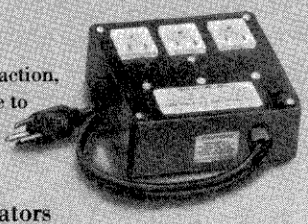

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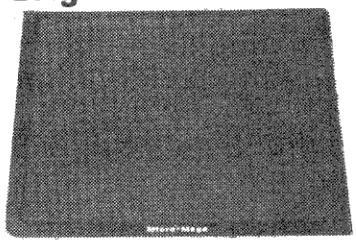

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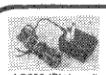

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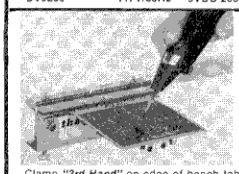
DC1200	120V/60Hz	9.5VDC 300mA	$2.95
DV9200	117V/60Hz	9VDC 200mA	$3.25



PCB-3 Makes Circuit Assembly A Breeze!

Lets you work with both hands. Sturdy aluminum construction.

Clamp *"3rd Hand"* on edge of bench table or workboard. Insert circuit board, position components. Notice convenient working angle. Flip circuit board to flat position for soldering and clipping. Reverse procedure for double-sided boards.

PCB-3 ..... $13.95

Extension-to hold PCB-3 2" from bench and 6" from front edge.

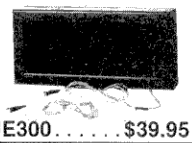
PCB-X $6.95

Mostek DC/DC Converter +5 VOLTS TO -9 VOLTS

Input: +5V. Output: -9V (regulated) @ 30mA. Printed circuit mounting. Specifications incl.

DC10 ..... $2.95 ea. or 2/$4.95

Jameco ELECTRONICS Digital Thermometer Kit



Dual sensors — switch controls for indoor/outdoor or dual monitoring — can be extended to 500 feet. Continuous LED .8" ht. display. Range: -40°F to 199°F, -40°C to 100°C. Accuracy ±1° nominal. Calibrate for Fahrenheit/Celsius. Simulated walnut case. AC wall adapter included. Size: 6¾"L x 3½"H x 1⅝"D.

JE300 ..... $39.95

RADIO CONTROL CIRCUITS

Ideal to use for:
- Toys, hobby crafts, robots, trains
- Burglar alarms • IR data link
- Remote slide projector control
- Consumer remote data links
- Energy-saving, remotely switched lighting systems

A complete F-channel digital encoder and RF transmitter; low power, at frequency of 27MHz or 49MHz, a field strength of 10,000uV meter at 3 meters. 9V operation on chip RF oscillator/transmitter, on chip 4.6 regulator. Up to 80MHz carrier frequency operation.

LM1871N RC Encoder/Transmitter Chip ... $1.95

A complete RF receiver/decoder, used at either 27MHz, 49MHz or 72MHz. It provides 4 independent channels when used with LM1871 (2 analog, 2 dig.) operates from four 1.5V cells, Crystal controlled.

LM1872N	RC Receiver/Decoder Chip	$2.49
SRX1504	49.435MHz Crystal (LM1872N)	$3.95
SRX1505	49.890MHz Crystal (LM1871N)	$3.95

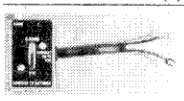
ATARI

ATARI PADDLES

JSP (2) ..... $4.95 pair

ATARI DRIVER

JSD(1) ..... $2.95 ea.



TV GAME SWITCH

Used on Atari. Cosmetically blemished. 100% functional.

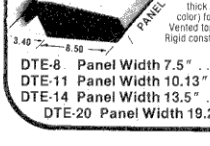
TGS-1 ... $2.95 ea.

BOOKS

NATIONAL SEMICONDUCTOR — INTERSIL — INTEL

30003	**National Linear Data Book (1982)** (1376 pages) LM, LF, ADC, DAC, LH Series	$11.95
30008	**National Memory Data Book (1980)** (464 pages) RAMs, ROMs, PROMs, EPROMs Series	$6.95
30009	**Intersil Data Book (1983)** (1356 pages) Complete line.	$9.95
30010	**National Audio/Radio Handbook (1980)** (240 pages) Pre-Amps, AM, FM & FM Stereo, Power Amps	$5.95
30011	**National Linear Application Handbook (1980)** (736 pages) Application Notes, Linear Briefs, etc.	$15.95
30012	**National PAL Data Book (1982)** (176 pages) Application Notes, Linear Briefs, etc.	$5.95
30013	**Zilog Data Book (1983)** (641 pages) Microprocessors and Support Chips	$7.95
210830	**Intel Memory Components Handbook (1983)** (798 pages) Contains all Application Notes, Article Reprints, Data Sheets, and other design information on Intel's RAMs, EPROMs, E²PROMs & Bubble Memories.	$14.95
210844	**Intel Microprocessor & Peripheral Handbook (1983)** (1027 pages) Contains Data Sheets on all of Intel's Microprocessors and Peripherals.	$14.95

Universal Computer Keyboard Enclosures

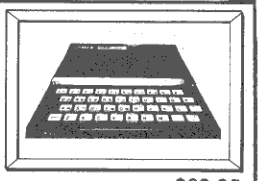


"DTE" Blank Desk-Top Enclosures are designed for easy modification. High strength epoxy molded end pieces in mocha brown finish. Sliding rear/bottom panel for service/component access. Top/bott. panels .080" thick alum. alodine type 1200 finish (gold tint color) for best paint adhesion after modification. Vented top & bottom panels for cooling efficiency. Rigid construction provides unlimited applications. Assembly instructions included.

DTE-8 Panel Width 7.5" $24.95
DTE-11 Panel Width 10.13" $27.95
DTE-14 Panel Width 13.5" $29.95
DTE-20 Panel Width 19.25" $34.95

TIMEX sinclair 1000

• Powerful - fully programmable 2K memory • Portable - 6⅞" x 6⅛" x 1⅜" - 12 oz. • Expandable - Optional 16K RAM module • Single-key entry commands • Educational • Unique syntax-check report codes for error identity • Accurate to 9½ decimal places for full range math and scientific functions • Graph drawing and animated display • Advanced 4-chip design combining power, portability and affordable price.



TS1000 ..... $69.95

ACCESSORIES FOR TIMEX sinclair 1000 and ZX81

TIMEX sinclair 1016 Expansion from 2K to 16K, size: 3" x 3" x 1.5" (5 oz) ... TS1016 $49.95

TIMEX sinclair 2040 32 column thermal printer (4 lbs) TS2040 $99.95

Keyboard Mask for Your ZX81/1000* Computer

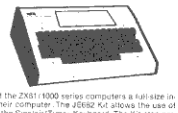
FEATURES:
- Install in seconds. Remove adhesive backing from mask and place over keyboard.
- All characters and symbols reproduced on mask.
- Durable — formed with polycarbonite sheet satin finish.

JE681 KEYBOARD MASK

The JE681 Keyboard Mask provides users of the ZX81/1000 series computer the individual feel of each keypad on the keyboard. The mask has a raised outline around each keypad allowing the user to feel and correctly position their fingers onto the keyboard.

JE681 KEYBOARD MASK ..... $9.95 each

Jameco ELECTRONICS ZX81/1000* Keyboard Conversion Kit



JE682 AK KEYBOARD KIT MOUNTED IN DTE-AK ENCLOSURE LIGHT TAN PANELS WITH MOLDED DARK BROWN END PIECES. SIZE: 14⅛"W x 3½"D x 3⅛"H

The JE682 Kit provides users of the ZX81/1000 series computers a full-size industrial keyboard hook-up to their computer. The JE682 Kit allows the use of either the full-size keyboard or the Sinclair/Timex Keyboard. The Kit also permits the simple disconnection of the Sinclair/Timex Keyboard for portable use. The JE682 Kit consists of a full-size industrial grade keyboard with 62 keys, 2 p.c. boards, 24" ribbon cable, DIP socket and 4 rubber feet. The keyboard conversion kit can easily be mounted into the DTE-AK enclosure. This enclosure is large enough to contain the ZX81/1000 computer and the full-size keyboard together. A handy label representing the ZX81/1000 keyboard layout is placed on the enclosure.

JE682-AK Keyboard Conversion Kit ..... $99.95 ea.
(WITH DTE-AK CASE – AS PICTURED)

JE682 Keyboard Conversion Kit ..... $59.95 ea.
(WITHOUT DTE-AK CASE)

80-Key Keyboard

CA150C $69.95

84-Key Keyboard

CA153A $69.95

95-Key Keyboard

CA154A $79.95

CONTROL DATA KEYBOARDS

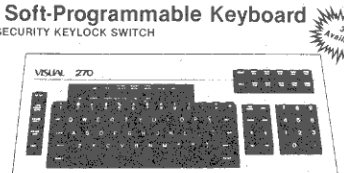
- ★ Parallel ASCII
- ★ SPST Switching
- ★ FTZ Shielded Base
- ★ N-Key Rollover
- ★ 128 Character ASCII
- ★ Non-Slip, Non-Glare Keycaps
- ★ CDC752 Terminal Keyboards
- ★ Attractive Case

These Control Data Keyboards consist of a base, cover, the keyboard assembly, and an interface cable. Color (case): Harvest gold and black. Color (keycaps): Black, blue, and red. Electrical requirements: +5V @ 600mA, -12V @ 50mA. Weight: 6 lbs. All units brand new in original boxes, specifications included.

Keytronics 90-Key Soft-Programmable Keyboard

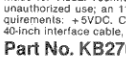
WITH SECURITY KEYLOCK SWITCH

- RFI shielded
- Cursor controls
- Numeric keyboard
- 8-bit Parallel
- Capacitance keys
- 10 user-programmable keys
- Positive TTL Logic
- Size: 17"L x 8¼"W x 2¼"H



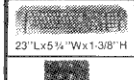
Made for Visual Technology, this keyboard features: a security keylock (includes two keys) to guard against unauthorized use; an 11-key numeric keypad; cursor controls; and 10 user-programmable keys. Electrical requirements: +5VDC. Color (case): White. Color (keycaps): Black. Complete with case, keyboard assembly, 40-inch interface cable, and schematics. Weight: 7 lbs.

Part No. KB270 ..... $109.95 each



23"Lx5¼"Wx1-3/8"H

MICRO SWITCH 85-KEY KEYBOARD
Word Processing Keyboard, 26 Pin Edge Card Connection. Supply Voltage +5VDC. Main Keyboard is QWERTY. Additional Key Pads for Cursor and word processing functions.
Part No. 85SD18-1 ..... $29.95 each



3"L x 3"W x 1½"H

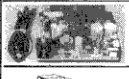
HI-TEK 14-KEY NUMERIC KEYPAD
SPST switching. Charcoal grey keycaps. Mounted on printed circuit board.
Part No. K-14 ..... $9.95 each

9¾"L x 4½"W x 1¾"H

ALPS 29-KEY CALCULATOR KEYBOARD
Features one 8-position decimal select switch, one 3-position switch, and two 2-position switches, mechanical SPST switching, 22-pin edge card connection. Pin-out included.
Part No. KB297040 (Fits DTE-11 Enclosure) ..... $4.95 each

POWER SUPPLY +5VDC @ 1 AMP REGULATED *Transaction Tech*
Output +5VDC @ 1A (also +30VDC) reg. Input 115VAC 60Hz, 2-tone (black/beige) self-enclosed case. 6 ft., 3 cond. black power cord. 6½"W x 7"D x 2¾"H. Wt. 3 lbs. Data sheet incl.
Part No. PS51194S ..... $14.95 each

POWER SUPPLY +5VDC @ 3 AMP REGULATED *Deltron*
Input: 115VAC, 47-440Hz. Output: 5VDC Adjustable @ 3 amp, 5VDC @ 2.5 amp. Adjustable current limit, Ripple & Noise: 1MV rms, 5MV p-p — 2 mounting surfaces. UL recognized. Size: 4"W x 4½"L x 2-7/16"H - wt. 2 lbs. Data sheet included.
Part No. QPS-1 ..... $29.95 each



POWER SUPPLY +5VDC @ 7.5 AMP, 12VDC @ 1.5 AMP SWITCHING
Input: 115VAC, 50-60Hz @ 3 amp/230VAC, 50Hz @ 1.6 amp. Fan volt./power supply select switches (115/230VAC). Output: 5VDC @ 7.6 amp, 12VDC @ 1.6 amp. 8 ft. blk. pow. cord. 11½"W x 13¼"D x 3¾"H. Wt. 6 lbs.
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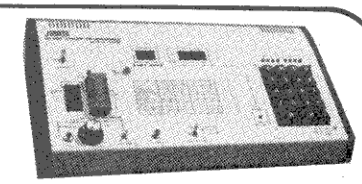

2708,2716,2732 & 2764 EPROM Programmer

JE664 EPROM PROGRAMMER

8K TO 64K EPROMS — 24 AND 28 PIN PACKAGES

— PROGRAMS 2716'S IN 16 SECONDS —

• Programs, validates, and checks for properly erased EPROMs • Emulates PROMs or EPROMs • RS232C Computer Interface for editing/program loading • Loads data into RAM by keyboard • Changes data in RAM by keyboard • Loads RAM from an EPROM • Compares EPROMs for content differences • Copies EPROMs • Power Input: 115VAC, 60Hz, ◄ 10W power consumption • Enclosure: Color-coordinated, light tan panels w/molded mocha brown end pieces • Size: 15-5/8"L x 8¾"D x 3⅝"H • Wt.: 5¾ lbs.

JE664-A EPROM Programmer $995.00
Assembled & Tested (Includes JM16A Module)

JE665 — RS232C INTERFACE OPTION — The JE665 RS232C Interface Option implements computer access to the JE664's RAM. Sample software written in BASIC provided for TRS-80® Model I, Level II Computer. Baud rate: 9600. Word Lgth.: 8 bits - odd parity. Stop bits: 2. Option may be adapted to other computers.

JE664-ARS EPROM Prog. w/JE665 Option $1195.00
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EPROM JUMPER MODULES — The JE664's JUMPER MODULE (Personality Module) is a plug-in Module that pre-sets JE664 for proper programming pulses to the EPROM & configures EPROM socket connections for that particular EPROM.

Part No.	EPROM	EPROM MANUFACTURER	PRICE
JM08A	2708	AMD, Motorola, National, Intel, TI	$14.95
JM16A	2716,TMS2516	Intel, Motorola, National, NEC, TI	$14.95
JM16B	TMS2715	Motorola, TI (+5,-12, +12)	$14.95
JM32A	TMS2532	Motorola, TI	$14.95
JM32B	2732	AMD, Fujitsu, NEC, Hitachi, Intel	$14.95
JM32C	2732A(21V)	Fujitsu, Intel	$14.95
JM64A	MCM68764, MCM68L764	Motorola	$14.95
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TRS-80 to 16K, 32K, or 48K

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TRS-80 Color 32K or 64K Conversion Kit

Kit comes complete with 8 each 4164-2 (200ns) 64K dynamic RAMs and conversion documentation. Converts TRS-80 color computers with D and E circuit boards, and all new color computers to 32K. Minor modifications of 32K memory will allow the use of all 64K of the dynamic RAM providing you have a FLEX DOS operating system.

TRS-64K2 ..... $54.95

IBM MEMORY EXPANSION KIT

SAVE HUNDREDS OF $$$ BY UPGRADING MEMORY BOARDS YOURSELF!

Most of the popular memory boards allow you to add an additional 64K, 128K, 192K, or 256K. The IBM64K Kit will populate these boards in 64K byte increments. The kit is simple to install — just insert the nine 64K RAM chips in the provided sockets and set the two groups of switches. Directions are included.

IBM64K (Nine 200ns 64K RAMs) $59.95

5¼" Mini-Floppy Disk Drive

Pertec Computer Corp.

FOR TRS-80 MODEL I (Industry Standard)
Features single or double density. Recording mode: FM single, MFM double density. Power: +12VDC (±0.6V) 1.6A max., +5VDC (±0.25V) 0.8A max. Unit as pic. at right (does not incl. case, power supply, cables). 30-pg. data book incl. Wt. 3½ lbs. Size: 5¾"W x 8"D x 3¼"H.

Part No.	Limited Quantity!	Price
FD200	Single-sided, 40 tracks, 250K bytes capacity	$179.95
FD250	Double-sided, 35 tracks, 438K bytes capacity	$199.95

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- Shugart 801R compatible
- Single-Sided
- 77 Tracks
- 400/800K Bytes Capacity
- Industry Standard

The **FDD100-8** 8" Floppy Disk Drive (Industry Standard) features single or double density. Recording mode: FM single, MFM double density. Transfer rate: 250K bits/sec. single density; 500K bits/sec. double density. The FDD100-8 is designed to work with the single-sided soft sectored IBM Diskette I, or eq. disk cartridge. Power: 115VAC @ 50-60Hz, +24VDC @ 1.7 amps max., +5VDC @ 1.2 amps max. Unit as pictured above (does not include case, power supply, or cables). Size: 8.55"W x 14"L x 4.5"H. Weighs 12 lbs. Incl. 96-pg. manual.

Part No.	Price
FDD100-8	**$169.95 ea.**

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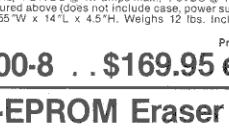
8 Chips — 51 Minutes



1 Chip — 37 Minutes

Erases 2708, 2716, 2732, 2764, 2516, 2532, 2564. Erases up to 8 chips within 51 minutes (1 chip in 37 minutes). Maintains constant exposure distance of one inch. Special conductive foam liner eliminates static build-up. Built-in safety lock to prevent UV exposure. Compact — only 9.00" x 3.70" x 2.60". Complete with holding tray for 8 chips.

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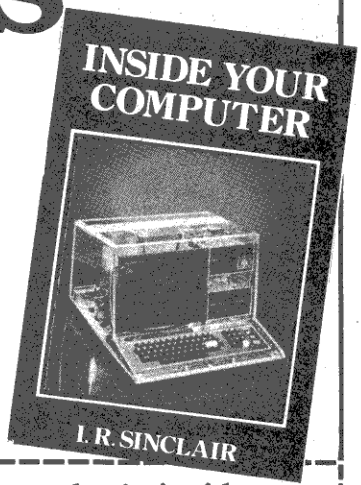

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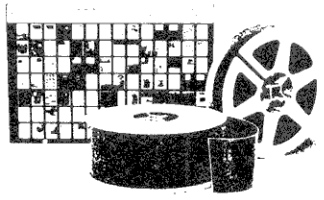

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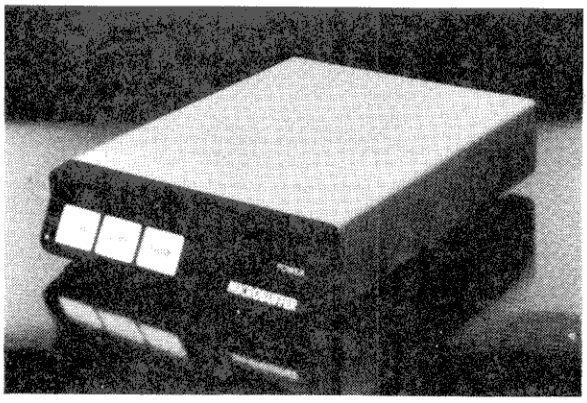

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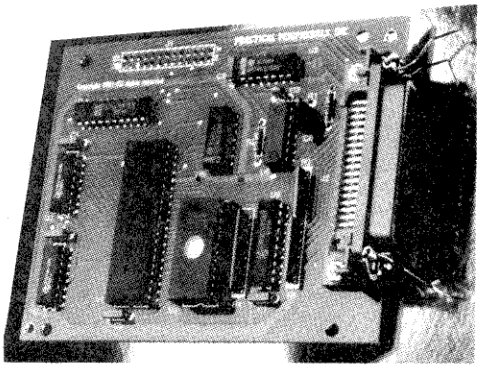

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The MBP-16K supports all standard Epson Commands, is compatible with GRAFTRAX-80, and is plug compatible with the standard Epson cable. The MBP-16K does not require any user software for control.

The MBP-16K is easy to install — it simply plugs into the existing auxilliary interface connector inside the Epson without modification of the printer.

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NEWS THIS MONTH

Fade to black for the white CoCo, love on the line, CRT headaches, crime, Comdex, and advice for family units.

HARDWARE

R.I.P. TDP

Tandy's "other" Color Computer leaves the market.

BY JOHN P. MELLO JR.

80 MICRO NEWS EDITOR

Tandy's grand experiment hawking computer products outside its Radio Shack distribution chain will apparently whither away this year. According to one Tandy Distribution Products executive and several TDP distributors, the Fort Worth firm will stop distributing its Color Computer clone once it's exhausted inventories of the machine at its North Carolina warehouse.

"At some point in time this year," explained Gary Laws, computer specialist for TDP, "we will be out of inventory and there won't be any more TDP computers after that."

Tandy Distribution Products, which include television antennas, are distributed through independent RCA dealers throughout the United States.

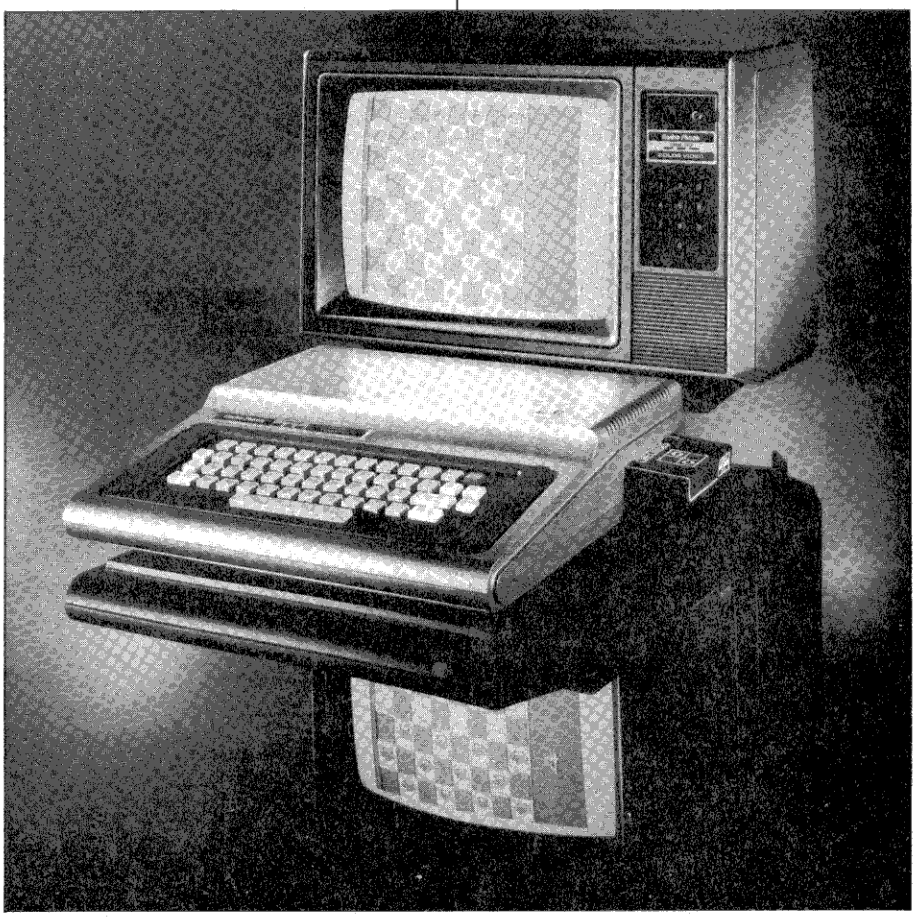
"I've told our distributors the facts —that eventually we're going out of business," the computer specialist said, "but I still have people out there anxious to sell TDP 100s as long as we're in business."

Although TDP sold $150,000 in computer products in March and despite predictions its CoCo clone would do better once planned price cuts took effect in May, Tandy decided to let the program die.

Laws, who said "several thousand" TDP units have been sold, explained: "Volumes were getting smaller and smaller and expenses were getting higher and higher. The division began losing money and it was mainly the warehousing and stockpiling of computers that caused it. In the Tandy Corporation, a division doesn't lose money —not for long or it ceases to be an operating division."

At least two distributors met TDP's decison with chagrin. "I think we've been betrayed," observed Bob Rosen of Spectrum Projects in Woodhaven, NY. And Darrell Edwards, general manager of Software Central in Westland, MI, said of the move, "I'm not happy about it."

Laws assured TDP owners their machine would not be "orphaned" by Tandy. "It's not going to be aban-



While the CoCo's checkered past (or at least its image as a games-only machine) is over, the white-cased TDP version was an experiment that failed.

doned," he said. "A decision was made on high that it was costing us too much to deal with the competition."

However, Edwards of Software Central said his firm will stop carrying TDPs because once his customers hear the computer line will be discontinued, they'll be mad. "We don't want to be involved in selling something to the public that will make them feel like they've been had. A lot of people are going to feel that way."

Laws said TDP's 52 service centers would continue to service the computers after the program ends. Rosen believed even local Radio Shack stores would service them. But Edwards was skeptical.

"If I buy a Chevy and Chevrolet goes out of business," he said, "General Motors may say it'll back up the Chevy. But when I take it to a Buick dealer to be repaired, he's going to say, 'Whoa, that's a Chevy.' A lot of people are going to be afraid of that."

Laws explained the TDP program had name recognition and pricing problems from its inception.

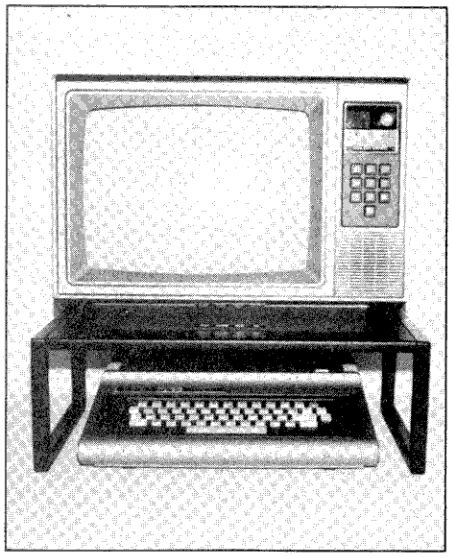
"TDP was one of the best kept secrets in the world," Rosen declared.

Laws admitted: "No one knew what a TDP system was. If you put the TDP 100 beside the VIC-20 with the usual type of person that was in the store as a clerk, a customer would buy a VIC-20 10 times what they would buy a Color Computer—even though the VIC-20 isn't half or a third the machine the Color Computer is."

"If the clerk wasn't an enthusiast," the TDP executive continued, "he wouldn't bother saying, 'Look, I know this is only $135 but it's only worth that much, too. If you buy a Color Computer, you get an extremely sophisticated 6809 microprocessor that makes the machine quite different from the other stuff on the market.'

"They wouldn't explain that there's more third-party software for the Color Computer; that the only people that probably had more third-party software was Apple; that for a couple of hundred dollars you could come away with a 64K computer that could run rings around any other 64K computer. I know these things, but the buying public doesn't know them."

Rosen complained there was a woeful lack of advertising for the machine. "I spent more money on advertising," he claimed, "than a $2 billion company spent on their own product."



The original CoCo: More expensive than the VIC-20, but $80 less than the TDP version.

He said he had difficulty obtaining even flyers about the computer. "When I couldn't get any more of those four-color flyers," he noted, "I knew something was up."

"We were aware of the name-recognition problem," Laws said, "but the thing that killed us was the volatility of the market."

He explained: "When we went into production, the TI [Texas Instruments 99/4E] was $549, the VIC-20 was $299, and an Atari 800 was $899. Our price was lower than those and we had a better machine."

But Rosen contends the TDP computers were not price-competitive from their beginning. "The suggested retail price for the 16K with Extended Basic was $479, which was crazy," he said. "That's $80 more than what the company stores were selling them for. It was $175 more than what Computer Plus [a large mail-order house] was selling it for."

"The margin was only 25 percent," he continued, "so even if you discounted it, you were still higher than Radio Shack stores."

He added, "The only way I made any profit was to do what people selling Model IIIs do. I bought the basic model and put my own memory chips in it. I was selling 64K for $499."

One distributor, who asked his name not be published, said his experience with dealers in the half-dozen states he supplies with TDP products was a mixed bag. "We've had some dealers who carried TDP 100s and did nothing with them," he observed. "The machine essentially sat there. The dealers were pushing Atari. They didn't feel TDP was competitive enough to get behind—even though the margins were better than on those other machines. Some dealers have gone wild with it. It's been a strange market to say the least."

"We told our dealers," Laws said, "these machines, by their very nature, would never sell like Atari or VIC-20. You're going to have to train your sales people to sell these machines because they require a little selling. They don't jump off the counter into people's hands."

"Then they get into business with us. They get Sinclair and TI and Commodore. Those machines sell like mad. The dealer sells every one he can get. They don't make much money, but they really do the numbers. He gets busy with those computers and tends to ignore ours.

"He could get bigger margins on our machines than on our competitors', but most of our dealers were too lazy to do that. They would rather make $5 on a VIC-20 than $100 on one of our machines."

"When you sit down and analyze who was going to push the machines," Edwards said of TDP's computer venture, "they were not in the right hands. If they had been in the hands of people who knew computers and were thinking computers, TDP could have taken off a lot better than it did."

One market analyst appears to agree with Edwards. "I don't think Tandy really understood what was needed," commented Aaron C. Goldberg, research manager for information systems at International Data Corporation in Framingham, MA. "It was a good idea if it was carried out well. It seemed like a half-baked effort to me."

Clive Smith, a senior analyst at the Yankee Group in Boston, MA, added: "It was just an experiment. There was never a major corporate commitment behind it."

Through the TDP program, he explained, Tandy learned "that because they are not the price performance leaders, it's going to be difficult for them to develop significant alternative distribution channels against people like TI and Commodore, so they're best off concentrating on their own distribution network." ■

COMMUNICATIONS

Saturday Night Beeper

Our eligible reporter joins the lonelyhearts network.

Grevstad as seen in his college yearbook (1980): The woman's a model and the car was borrowed.

BY ERIC GREVSTAD

80 MICRO STAFF

Mail-order romance is as old as the postal service, and bulletin boards are as old as the Network Nation. Single people have blundered into each other on The Source or CompuServe, posting public messages and taking their chances (see *80 Micro*, December 1982, p. 412).

But matchmaking by modem—a special-interest BBS for eligible women and men, for those seeking to find a sweetheart instead of seeking to swap Model I disks—didn't begin until Burbank, CA programmer Gregg Collins launched Dial-Your-Match #1 in October 1981. Today, more than 20 such boards are on line from Fairbanks, AK (907-479-0315) to Marseille, France (011-33-91-91-0660).

As *80 Micro*'s most unattached bachelor, I was assigned to investigate the phenomenon. I spent several weeks on nine boards. I'm still single, but now I'm single nationwide.

216-932-9845: "This board lives for love in majestic Cleveland, Ohio." Not a bad BBS; some interesting items on the questionnaire and a 13th choice ("That's absurd") in addition to the usual options for "What's your sign?" But quieter than downtown Peterborough on Monday night—only 72 people in the data base when I called and a plea in the opening message for more women (I found a total of 10). No action in Cleveland.

Perhaps because they're accessible for the price of a phone call, with no CompuServe-style user fees, the matchmaking boards are extremely popular. New York (212-541-9175) and Houston (713-556-1531) were busy every time I dialed over a period of two weeks.

After reaching a carrier tone and logging on, newcomers must fill out a questionnaire, starting with first name and hometown and going on to sexual preference—hetero-, homo-, or bisexual, as opposed to specific acts or positions (though a raunchy board in Freehold, NJ, 201-462-0435, asks about them, too).

The other questions ask about age ("Under 12" is a choice), height, weight, eye and hair color, and so on. There are invariably items about tastes in music and hobbies. Nearly every board asks whether people in a relationship should stay faithful or fool around; some ask how far it's okay to go on a first date.

Finally, callers receive a password, which lets them skip the quiz in future calls, and an address code, one's name

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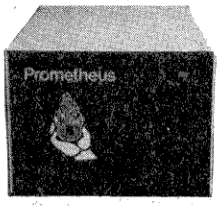

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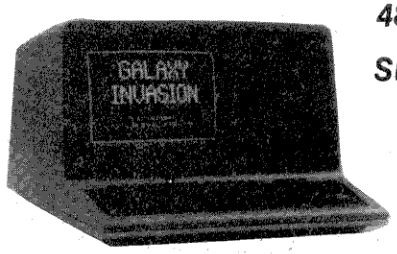

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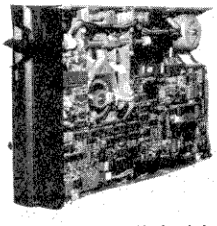

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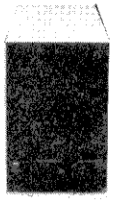

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plus a three-digit number. The address code lets people send you mail. The password makes sure only you can read it. The questionnaire is put on file, and puts you into the public domain.

Burbank, CA, 213-842-3322. DYM #1, Gregg Collins' original—"The Only World-Wide Computer Matching Service," roughly 700 callers in the "date-a-base." I wrote two 21- to 25-year-old Floridians, Lisa and someone called Mirthwind, cracking my icebreaking joke about the questionnaire's attitude-toward-life choices ("Intelligent/Serious, Cheerful/Realistic, Romantic/Optimistic"): "Is the outlook 'Cheerful/Realistic' a contradiction in terms?" No answers.

Before you can write people, you have to find them. The BBS command M ("Matchmaker, make me a match") triggers a scan of relevant questionnaires (in my case, those of heterosexual women) and a comparison of their and your answers. The process takes a minute or two for uncrowded boards, up to 10 minutes for popular ones. Some boards let you set your own standards, telling the computer to list only those above a certain percentage of compatibility.

The M command results in a list of prospects, giving address code, home state, sexual orientation, and match percentage. The closest match I ever found (discounting 100 percent when I tried entering my own address code) was 82 percent with a woman in Torrance, CA.

I hurried to the next command, B ("Browse questionnaires"), and entered her address code; I learned that she was 21 to 25, somewhere between 5'-5'4" and 125-140 pounds, a brunette, Taurus, and believed couples should stay faithful. I also learned that she hadn't called the board in a month, and that all five spaces in her mailbox were full.

Omaha, NE, 402-571-8942. This looked like a wonderful board—a good questionnaire, lots of candidates in my age group, 70-percent compatibility matches with Janine of Iowa (my old grad school turf) and Mariana, a green-eyed brunette from Louisiana. I wrote them my standard witty letter. Neither wrote back.

Once you've found and browsed a prospect, the crucial step is to send a letter. Entering the recipient's address code and a one-line subject (I used "Letter from New Hampshire"), you're then given 10 (sometimes 20 or even 99) lines to make a good impression.

I have no idea which opening lines work best. Rather than try my usual approach (I popped the most important question of high school with "Are you free at all promwise?"), I hid behind my role as reporter—"What've your experiences on the BBS been like? How did you get involved with computers?" Once or twice I found myself using a tone with gold chains around its neck—"Write and let's read between the lines of the questionnaire." It didn't work.

Eric's Little **Black Book**

A list of matchmaking boards in operation as of April 11, 1983:

Fairbanks, AK	907-479-0315
Burbank, CA	213-840-8252
Burbank, CA	213-842-3322
Burbank, CA	213-842-9452
Clovis, CA	209-298-1328
Daly City, CA	415-991-4911
Glendale, CA	213-242-1882
La Palma, CA	714-220-0239
No. Hollywood, CA	213-764-8000
San Francisco, CA	415-467-2588
Santa Monica, CA	213-390-3239
Sherman Oaks, CA	213-783-2304
Sherman Oaks, CA	213-990-6830
Tarzana, CA	213-345-1047
Crystal River, FL	904-795-8850
Atlanta, GA	912-233-0863
Hammond, IN	219-845-4200
Cleveland, OH	216-932-9845
Lynnfield, MA	617-334-6369
Omaha, NE	402-571-8942
Cranford, NJ	201-272-3686
Freehold, NJ	201-462-0435
New York, NY	212-541-5975
Cary, NC	919-362-0676
Newport News, VA	804-838-3973
Vancouver, WA	206-256-6624
Marseille, France	011-33-91-91-0660

Santa Monica, CA, 213-390-3239. Marc Schoenberg's MMMMMM (Marc the Martian's Mixed-Up Matching and Message Machine), open 24 hours with hard disk: one of the better matchmaking boards, despite a comparatively skimpy questionnaire. Lori, an L.A. 18-year-old, sent an unsolicited hello, making up for a strikeout with Julie of South Bay.

Julie's file revealed she owns an IBM PC; I made a quip about IBM and TRS-80 people being incompatible, and she huffed, "I don't think someone who owns a Radio Shack computer should cut down another person's computer!" Humorless IBM snob.

The greatest joy in the lonely-modems world is logging on and seeing the message, "You have mail waiting." As the Cleveland BBS indicates, men far outnumber women on matchmaking boards, and women are far more likely to be courted with unsolicited mail. (Lori of L.A.: "There is a lot of mail being sent to me from desperate guys who don't match anyone and don't care who they send mail to.")

80 Micro assistant editor Mary Ruth, age 25, joined the Cary, NC, data base (919-362-0676) and had four letters waiting when she checked back. One suitor was in his 40s; another, in his 50s; and one tried the old standby, talk about the weather, by sending five lines of asterisks to indicate that North Carolina had had snow.

Newport News, VA, 804-838-3973. Hee Haw humor, but the only amusing Dial-Your-Match around: The first message after reaching the carrier tone tends to be a line like "Leroy boy! Is that you?" The Whogins, postmaster of the board, has replaced "You have mail waiting" with "Great Googlie Mooglie! You've got some dad-gum mail!" Enter D to delete a message, and it's "Hang on! Let me find the pencil with the good eraser!" This adds a minute or two to your phone bill, but better corny jokes than Cary, NC's mandatory ads for software and peripherals. The board seems to be popular with the Norfolk naval base.

Do matchmaking boards work? In terms of eventual marriage, probably not. A few users have married, but most summarize their correspondence as does Julie, the California IBM buff:

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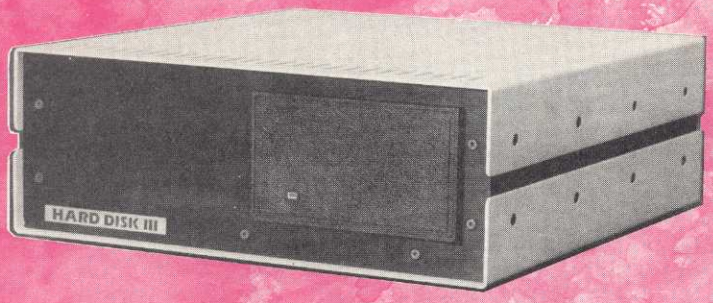

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"I've never met anybody, but I've been writing to some very interesting people."

Still, the boards are at least an opportunity for friendly banter, and occasionally a chance for more. Anda, a Tampa, FL, programmer, says "I find this method very nonthreatening... In the long run, I've written to many and keep in touch with some." One correspondent, she says, eventually came to visit in person, and the two had a "most pleasant time... I really value our relationship, whatever is to become of it."

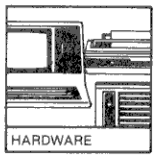
The odds that true love will come by modem are no better than those for its coming from classified ads. But the odds for getting a response, if only a polite rejection—after all, you're writing to individual people rather than buying newspaper space—are much shorter. As gambits go, it's an improvement.

Vancouver, WA, 206-256-6624. Jane, you heartbreaker:

"Hi, Eric. Seems that we have a high percent match. Thanks for the message but this weekend I leave for Montana to continue college. I will not have access to a computer. Sorry.—Jane454."■

PULSE TRAIN

CRTs: safety doesn't sell



Evidence, or at least discussion, of health hazards associated with CRT terminal use is mounting (see *80 Micro*, December 1982, p. 382). So far, however, safety and convenience have not caught on in the marketplace.

In the January 1983 issue of *Inc.*, Craig R. Waters quotes National Institute for Occupational Safety and Health (NIOSH) statistics showing that CRT users, compared to paper pushers, are 20 to 30 percent more likely to develop ailments ranging from aching heads and stiff shoulders to blurred vision, eyestrain, and skin rash.

Jon Ryburg of Facility Management Institute, a consulting and research firm associated with the office furniture maker Herman Miller Inc., says that employees who spend more than 20 to 30 percent of their time at a CRT suffer 8 to 20 percent reductions in comprehension, speed, and accuracy.

Fatigue and irritability are other symptoms; NIOSH found that CRT operators display higher stress ratings than air traffic controllers—or any other group of workers ever tested.

Sweden and Germany have adopted, and NIOSH and several labor associations have proposed, standards for regulating CRT design: adjustable screens, glare-free glass, contrast and brightness controls, a character size larger than 3mm, and so on. The U.S. has not adopted such standards.

And among executives who buy electronic office equipment—though approximately 5 million CRTs are now in use, with 10 million expected by 1985—user-friendly features are a drug on the market.

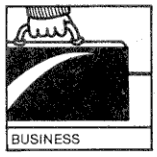
According to a study by Advanced Resources Development of Medfield, MA, only the detachable keyboard (made famous by IBM's PC) has caught on with American buyers. Tilt screens and nonglare screens are beginning to attract CRT shoppers' notice, but other ergonomic or comfort-oriented features are given low priority.

Says Mary Owen of ARD, "Users are looking for a certain standard of functionality in CRTs which has already been fulfilled on a widespread basis. Beyond this standard, users don't seem to attach much importance to additional features, which do not appear to improve the basic functioning of the machine."

The Medfield study points out that the percentage of CRTs in dedicated data entry (i.e., full-time) use is declining, giving less incentive for change for convenience's sake, and that European-style Federal regulations are unlikely. It seems American workers will be getting headaches for some time.

Is this a hazardous work environment? Concern about CRT side effects is growing.

Broker snubs micros for office networks



According to their advertisements, "When E.F. Hutton talks, people listen." Recently, a Hutton executive revealed the brokerage house's computer strategy for the '80s, and listeners responded with squawks of disbelief and skepticism.

Norman Epstein, Hutton's executive vice-president of operations, told surprised attendees at a Fortune 1,000 Personal Computer Market Forum that his firm has rejected the use of microcomputers in upgrading its existing network of 5,000 dumb terminals. Instead, the terminals will be connected to time-shared superminis—a Data General Corp. Eclipse MV/4000 in each of Hutton's 350 branch offices.

While Hutton is bucking the personal computer boom, Epstein contends the Eclipse "brain transplant" will give the terminals the strength of micros, but retain communications and data consistency with the broker's Compass teleprocessing network. Above the MV/4000s in the hierarchy are 26 integrated Eclipse mainframes at 16 remote sites, and at top a

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The Microwriter's print quality is identical to the finest office typewriters on the market. This machine is not only perfect for letters and manuscripts, but with it s 165 character, 12 inch print width, the machine is perfect for letter quality budget spread sheets, price lists, data sheets, and forms.

The Microwriter can tab, rule single lines both vertical and horizontally, underline and print at 10, 12, or 15 characters per inch (switch selectable)! Its ten character memory for automatic error correction, lift off correction ribbon, and fixed or programmable page formats are a few of the many features that make it a perfect office typewriter. Microwriter not only handles letter and legal size sheet paper in widths up to 12 inches wide, but also handles fanfold paper.

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complex of IBM 3033 and 3083 mainframes at Hutton's New York headquarters.

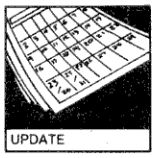
"We want to extend personal computing power as far down into our organization as we can go and still maintain central control," Epstein told *Computerworld*'s Jeffry Beeler. "If what you want is integrated solutions, personal computers can be a real problem."

Others at the San Francisco forum, sponsored by Richardson, TX market-analysis firm Future Computing Inc., saw Hutton's move as anachronistic. Many doubted whether a plan to discourage the widespread use of micros could be enforced, and some vendors suggested that offices might ignore the central order and install machines anyway.

"Our company has just recently signed an agreement with E.F. Hutton to supply the UCSD p-System for the dozens of personal computers the firm has already installed or has on order," said James Bandy of SofTech Microsystems Inc. "I'm not at liberty to say where in E.F. Hutton the systems are going to be installed. I'll let (Epstein) find out for himself."

A Hutton spokesman said later that Bandy referred to micros in the company's insurance subsidiary, which operates independently of the brokerage firm.

Silicon SWAT team



"There are a million stories in the Silicon Valley. This is one of them. My name's Friday. I'm a cop."

While an Atari version of *Dragnet* hasn't shown up yet, the electronics companies of California's Santa Clara County now have their own friends on the force. The District Attorney's Technology Theft Association (DATTA) includes detectives from eight area police departments and the county sheriff's office, working under D.A. Leo Himmelsbach in a cooperative effort to fight high-tech theft (see *80 Micro*, March 1983, p. 368).

The task force, scheduled to launch operations in late April, features 18 investigators whose training includes 40 hours of computer literacy courses. Deputy district attorney Douglas Southard told *Computerworld*, "We don't have to be engineers, but we do have to know what an EPROM and systems software are. Otherwise, we won't even be able to communicate with the high-tech thieves' victims."

Communication is key. Besides specialized preparation, DATTA will rely on close contact with federal agencies and manufacturers' security departments.

According to the unit's coordinator, the combination of high-tech homework and pooled resources will give police a better chance against Silicon Valley's soft- and hardware pirates: "It's much like narcotics enforcement, where there is a small group of criminals," said Palo Alto Police Department Captain Robert Elliot. "A big part of our work is intelligence gathering."

However, as John Markoff of *InfoWorld* concludes, the jury of public opinion has reserved its verdict: "Himmelsbach recently won a bitterly contested election in which he argued that most of the district attorney's energies should go toward catching and prosecuting traditional criminals such as muggers."

Escape from Comdex

Have computer shows gotten too big? One manufacturer boycotted the Spring '83 **COMDEX** claiming the Atlanta exposition was no place to do business. Convergent Technologies of Santa Clara, CA, an OEM supplier of desktop workstations, says that Comdex has changed from an industry gathering to a massive event attracting unmanageable crowds. The Fall '82 show in Las Vegas featured about 60,000 people, 1,000 booths, and 2,000 exhibitors. ■ The same company has another complaint: "a growing pollution of '**ME-TOO**' products," stifling creativity for the sake of standardization. Pauline Alker, Convergent Technologies' vice president for marketing, points out that the Vegas show featured 19 look-alike Unix systems and 15 IBM PC clones. ■ The **CHILDREN'S TELEVISION WORKSHOP**, which recently launched a line of educational software, is starting a magazine designed to introduce kids to computers and other new technology. Called *Enter*, the monthly will include career profiles and how-to articles as well as games and programming puzzles. ■ There's another new magazine for IBM PC users, but it won't look good on your coffee table: Each issue of *Mentor* is a **DISK**, featuring a control program (documentation and table of contents) and several patches and templates for such programs as VisiCalc and 1-2-3. The San Francisco publisher envisions ads taking the form of self-running demos of software products. ■ Judging from the press release, pop-psych **JARGON** has invaded CompuServe: dataFamiliae, a service "for anyone considering having a family or . . . already living in a family unit," supplies information and advice on "parenting and family life, functioning physically and mentally, and special family matters and interrogatories." The latter are question-and-answer sessions. ■ The word from **TAIWAN** is "Game Over"—a nationwide ban has closed down all video arcades in the wake of police claims that the games produce juvenile delinquents who fight, steal, and rob to support their habit. The government has offered to purchase the games from licensed parlors (10,000 unlicensed arcades were shut last year), placing them in schools with computer courses and in homes for the elderly. ■ Speaking of the elderly, 91-year-old Edward L. Bernays, the "father of **PUBLIC RELATIONS**," joined Pace University's April workshop on computer use in that profession. Bernays, who "created and named the profession of counsel on public relations" and whose clients have ranged from Caruso and Nijinsky to Presidents Coolidge and Eisenhower, said, "I'm still in a learning mode, so it's time for me to keep ahead of my field." ■

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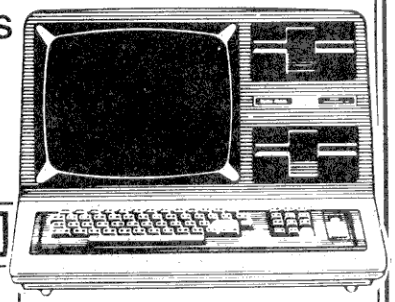

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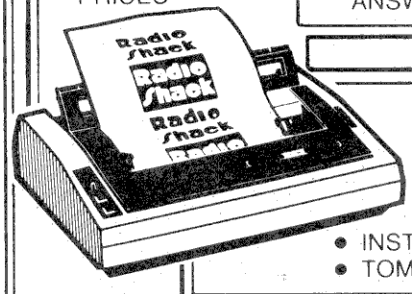

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TAKE II

This column will feature Model II, 12, and 16 conversions of earlier programs. Readers who have converted programs for their own use are encouraged to submit them.

The September 1982 issue of *Microcomputing* included an article called "Black Friday," a stock market simulation for the Commodore and Atari systems, written by Robert W. Baker. This version of the game was converted for the Model II by Byron Lott, 913 Inverness Way, Sunnyvale, CA 94087.

The game lets one to four players enjoy a realistic simulation of the stock market over a 10-year period (or 10 rounds).

The object of the game is to shrewdly invest your initial $5,000 in the game's 10 securities, buying and selling each year in an attempt to become the wealthiest player. All players receive annual dividends on every paying stock worth $50 or more. Each player gets a chance to sell any stock he owns or buy any stock he wants. There is no "selling short" in this game; a player must actually own the stocks he sells. A player must also have enough money to purchase the stocks he intends to buy; otherwise, an error message appears and he has to reenter the transaction.

Once each transaction is completed, an updated table shows the player's new holdings and cash on hand. When all the players complete their transactions, the following year's values are computed and the game continues. At the end of 10 years, each player's net worth is calculated and the wealthiest player wins.

Should the value of any stock drop to zero during the game, that stock goes bankrupt and all shares are surrendered. That stock's value is then reset at $100. If the value of a stock reaches $150 during play, the stock splits and any players owning shares receive the extra shares. When a stock splits, its value is halved (rounded to the next highest dollar).

Abbrev.	Security name	Div./Share
HIB	Highway Improvement Bonds	$5
XP	X-Pando Corporation	$1
SP	Seaside Properties Inc.	none
ODM	Old Dog Mutual Funds	$4
RD	Rubble Development	$7
SO	Slippery Oil Company	none
BT	Bumpy Transportation	none
KA	Krash Auto Company	$2
ZE	Zap Electronics	$6
BPL	Blinkey Power & Light	$6

Table 1. Stock market securities and dividends

The table shown after each year shows the year, the type of market (bull or bear), the change in value of each stock (+/−), current prices, and the number of stock shares each player owns. Any dividends for the year are shown, along with each player's total cash on hand.

The securities available for purchase and their respective dividends per share are shown in Table 1.

Program Description

Matrix M records each player's holdings, cash on hand, and dividends or interest for each year. Market changes for each year are determined by randomly selecting one of the 36 market vectors in Matrix A. Each of these vectors is selected only once during the game; element 10 is set to 1 when a vector is used.

The data vectors in this matrix alternately represent bull and bear markets. For a bull market, a vector is selected from Matrix U; for a bear market, a vector is selected from Matrix E.

The price change vector, also selected at random, is added to the market vector and stored in vector T. The price changes are also added to vector F, which keeps track of the current price of each stock. Vector I contains the dividends-per-share values, and vector S$ contains the valid stock abbreviations. ■

HIB—Highway Improvement Bonds (yield 5%). An excellent state bond with good security and income potential, but no appreciation.

XP—X-Pando Corporation (yield 1%). A rapidly expanding industrial firm that reinvests most earnings on research, causing low yield. The price-to-earnings ratio is extremely high.

SP—Seaside Properties Inc. (no yield). Good appreciation prospects but no dividends. In the immediate future, however, the proposed beach cleanup program could have great effect on earnings.

ODM—Old Dog Mutual Fund (yield 4%). A common stock mutual fund that represents a good, steady income, with only fair appreciation.

RD—Rubble Development (yield 7%). A high income real estate investment with steadily depreciating capital assets.

SO—Slippery Oil Company (no yield). Very speculative investment since profits go toward new oil wells. No dividends are expected.

BT—Bumpy Transport Company (no yield). High appreciation investment with a good outlook depending on the administrative ability of its new board of directors. No dividends are expected since all profits are recycled into the company.

KA—Krash Auto Company (yield 2%). A medium size auto company representing a somewhat high price-to-earnings ratio with a low yield.

ZE—Zap Electronics Inc. (yield 6%). A highly speculative, high income stock with a fair to poor long term prospect.

BPL—Blinkey Power and Light (yield 3%). A steadily growing utility company in an established industrial area.

Table 2. Securities prospectus

Program Listing

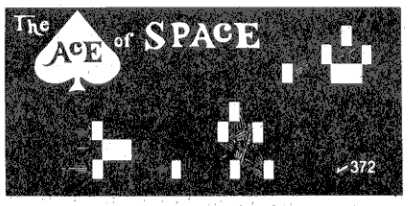
```
5 REM 31-AUG-82 *BDL*
10 CLS:PRINT@16,"$$$ BLACK FRIDAY STOCK MARKET GAME $$$":PRINT:PRINT
15 CLEAR2000
20 INPUT"INSTRUCTIONS REQUIRED (Y OR N)";Q$:IFQ$="Y"THEN845
25 DIMA(36,10),U(11,9),E(11,9),M(4,12),I(10),T(10),F(10)
30 S$="*HIBXP SP ODMRD SO BT KA ZE BPL*"
35 PRINT:PRINTTAB(22)"*** INITIALIZING DATA ***"
40 FORX=1TO10:READN:NEXTX
45 FORN=1TO36:FORJ=1TO9:READX
50 A(N,J)=X:NEXTJ:NEXTN
```

Listing continues

Listing continued

```
 55 FORR=1TO2:FORN=1TO11:FORJ=1TO9:READX
 60 IFR=1THENU(N,J)=X
 65 IFR=2THENE(N,J)=X
 70 NEXTJ:NEXTN:NEXTR
 75 REM - STOCK YIELDS (DIVIDENDS)
 80 DATA 5,1,0,4,7,0,0,2,6,3
 85 RESTORE:FORN=1TO10:READI(N):F(N)=0:T(N)=100:NEXTN
 90 FORN=1TO4:FORJ=2TO12:M(N,J)=0:NEXTJ:M(N,1)=5000:NEXTN
 95 FORN=1TO36:A(N,10)=0:NEXTN:Y=0
100 PRINT:PRINT"ENTER NUMBER OF PLAYERS (1 TO 4)";
105 INPUTR$:P=VAL(R$):IFP>4ORP<1THENPRINT:PRINT"SELECTION ERROR":GOTO100
110 REM **********
115 REM - COMPUTE PRICES
120 REM **********
125 CLS:PRINTTAB(21)"*** COMPUTING NEXT YEAR ***"
130 RANDOM:W1=0:D=RND(11)
135 C=RND(36)
140 IFA(C,10)=1THEN135
145 FORN=2TO10:IFINT(C/2)<>INT((C-1)/2)THEN155
150 R$="BULL":F(N)=A(C,N-1)+U(D,N-1):GOTO175
155 R$="BEAR":F(N)=A(C,N-1)+E(D,N-1)
160 REM **********
165 REM - CHECK STOCK SPLITS
170 REM **********
175 T(N)=T(N)+F(N):IFT(N)<150THEN215
180 PRINT"*** "MID$(S$,3*(N-1)+2,3);" STOCKS SPLIT ***"
185 J=INT(T(N)/2):IFT(N)/2THENT(N)=J:GOTO195
190 T(N)=J+1
195 FORJ=1TOP:M(J,N+1)=M(J,N+1)*2:NEXTJ
200 REM **********
205 REM - CHECK BANKRUPTIES
210 REM **********
215 IFT(N)>0THEN235
220 T(N)=100:FORJ=1TOP:M(J,N+1)=0:NEXTJ
225 PRINT"*** ";MID$(S$,3*(N-1)+2,3);" WENT BANKRUPT ***"
230 PRINT"THESE STOCKS ARE BEING SURRENDERED"
235 NEXTN
240 REM **********
245 REM - UPDATE DISPLAY
250 REM **********
255 FORN=1TOP:M(N,12)=0
260 FORJ=1TO10:IFT(J)>=50THENM(N,12)=M(N,12)+(I(J)*M(N,J+1))
265 NEXTJ:W1=TI:M(N,1)=M(N,1)+M(N,12):NEXTN:Y=Y+1:IFW1<1THEN275
270 IFW1-W1<30THEN270
275 PRINT"$$$$ YEAR  ";Y;"  $$$$  ";R$;" MARKET  $$$$"
280 IFY<>11THEN290
285 PRINT" CLOSING "                    +/-      NEW    .1..    .2..    .3..    .4.
290 PRINT:PRINT"                                                ---PLAYER HOLDINGS---"
295 PRINT"STK      CHNG    COST
.":PRINT
```

Listing continues



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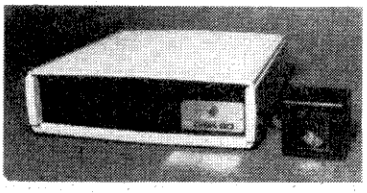

As featured in Ciarcia's Circuit Cellar
Byte Magazine, March 1981

Reviewed in March '82 "80 Microcomputing"

DSK01	Disk-80 Expansion Interface with 32k RAM A & T	$330.00
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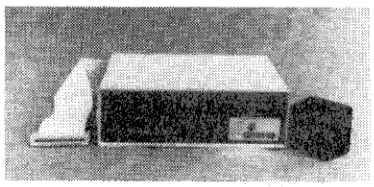
Comm-80



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Listing continued

```
300 FORX=1TO10:GOSUB485:NEXTX:PRINT:PRINT:PRINT"DIV'S THIS YR ";
305 R$="    "
310 FORJ=1TOP:PRINTTAB(28+((J-1)*13));(M(J,12));:NEXTJ:PRINT:PRINT:GOSUB500
315 IFY=11THEN510
320 REM **********************
325 REM - PLAYER TRANSACTIONS
330 REM **********************
335 FORN=1TOP
340 PRINT
345 PRINT"PLAYER #";N;" (B=BUY, S=SELL, D=DONE) ";
350 INPUTR$:IFR$="D"THEN440
355 IFR$="S"THEN395
360 IFR$<>"B"THEN340
365 REM - BUY SHARES -
370 GOSUB460:PRINT"NUMBER OF SHARES BUYING ";
375 INPUTR$:R=VAL(R$):IFR<1THENPRINT"BAD INPUT!":GOTO415
380 IFR*T(X)>M(N,1)THENPRINT"NOT ENOUGH MONEY!":GOTO415
385 M(N,X+1)=M(N,X+1)+R:M(N,1)=M(N,1)-(R*T(X)):GOTO430
390 REM - SELL SHARES -
395 GOSUB460:PRINT"NUMBER OF SHARES SELLING ";
400 INPUTR$:R=VAL(R$):IFR<1THENPRINT"BAD INPUT!":GOTO415
405 IFR<=M(N,X+1)THENM(N,X+1)=M(N,X+1)-R:M(N,1)=M(N,1)+(R*T(X)):GOTO430
410 PRINT"NOT ENOUGH SHARES!"
415 FORX=1TO100:NEXTX
420 GOTO340
425 REM - UPDATE DISPLAY -
430 GOSUB485
435 PRINT:GOSUB500:GOTO340
440 NEXTN:GOTO125
445 REM **************
450 REM - SUBROUTINES
455 REM **************
460 PRINT"STOCK ABBREV ";:INPUTR$:R$=LEFT$(R$+"    ",3)
465 W1=0:FORJ=0TO9:X=J+1
470 IFR$=MID$(S$,J*3+2,3)THENW1=1:J=9
475 NEXTJ:IFW1=1THENRETURN
480 GOTO460
485 PRINT:PRINTMID$(S$,3*(X-1)+2,3);:PRINTSPACE$(6);F(X);
490 PRINTSPACE$(6-LEN(STR$(F(X))));T(X);
495 FORJ=1TOP:PRINTTAB(28+((J-1)*13));M(J,X+1);:NEXTJ:RETURN
500 PRINT"CASH TOTAL = ";
505 FORJ=1TOP:PRINTTAB(25+((J-1)*13));M(J,1);:NEXTJ:PRINT:RETURN
510 FORN=1TOP:FORJ=1TO10:M(N,1)=M(N,1)+(T(J)=M(N,J+1)):NEXTJ:NEXTN
515 PRINT:PRINT"NET WORTH =    ";:GOSUB505
520 PRINT:PRINT:PRINT"PLAY AGAIN (Y OR N) ";
525 INPUTR$:IFR$="N"THENPRINT:PRINT"THANK YOU FOR PLAYING!!!":PRINT:END
530 IFR$="Y"THENCLS:GOTO85
535 PRINT:PRINT"SELECTION ERROR":PRINT:GOTO520
540 REM ************
545 REM - GAME DATA
550 REM ************
555 DATA 0,0,0,0,0,0,0,0,0,5
560 DATA 0,0,0,0,0,-25,0,0,0
565 DATA 0,0,0,0,0,0,0,15,0,0
570 DATA 0,0,0,-5,0,0,0,0,0,0
575 DATA 0,0,0,0,0,0,0,0,0,5
580 DATA 0,0,0,0,0,0,5,0,0,0
585 DATA 0,0,0,0,0,0,10,0,0,0
590 DATA 0,10,0,0,0,0,0,0,0,0
595 DATA 0,0,0,0,0,0,15,0,0,0
600 DATA 0,-5,0,0,0,0,0,0,0,0
605 DATA 8,5,5,0,0,0,7,0,0
610 DATA 0,0,0,0,0,0,0,0,-25,0
615 DATA 0,0,0,0,0,0,0,0,10,0
620 DATA 0,-10,0,0,0,0,0,0,0,0
625 DATA 0,5,0,0,0,0,0,0,0
630 DATA 10,0,0,0,0,0,0,0,0,0
635 DATA 0,0,0,0,17,0,0,0,0
640 DATA 0,0,0,0,-15,0,0,0,0
645 DATA 0,0,0,0,0,0,0,0,10,0
650 DATA 0,0,0,0,0,0,0,-15,0,0
655 DATA 0,0,0,0,0,0,0,10,0,0
660 DATA 0,0,0,0,0,0,0,-15,0,0
665 DATA 0,0,-8,0,8,0,0,5,0
670 DATA -10,0,0,0,0,0,0,0,0,0
675 DATA 8,0,0,0,0,0,0,0,0
680 DATA 0,0,0,0,0,0,0,-5,0,0
685 DATA 0,0,3,0,0,0,0,0,4
690 DATA -8,0,0,0,0,0,0,0,0,0
695 DATA 0,0,0,5,0,0,0,0,0
700 DATA 0,0,0,0,-10,0,0,0,0
705 DATA 0,0,0,0,0,0,10,0,0
710 DATA -8,-5,0,0,0,0,-7,0,0
715 DATA 10,0,0,0,0,0,0,0,0,0
720 DATA 0,0,0,0,0,0,0,0,-14
725 DATA -10,0,0,0,0,0,0,0,0,0
730 DATA 0,0,0,0,0,-5,0,0,0
735 DATA -2,-10,-7,-9,-2,-9,-7,-16,-4
740 DATA 26,16,25,8,-14,21,14,-4,17
745 DATA 18,23,11,12,46,18,-5,34,15
750 DATA 23,28,-2,11,56,19,30,29,14
755 DATA 20,15,15,7,-20,15,13,-10,12
760 DATA 17,21,13,-2,37,23,23,19,14
765 DATA 19,24,17,9,-5,26,13,-7,15
770 DATA 11,18,14,11,67,15,22,18,13
775 DATA 13,31,1,14,-11,18,18,-14,10
780 DATA 14,-8,19,-1,-9,25,-10,13,19
785 DATA 24,24,23,20,51,27,38,33,18
790 DATA 12,14,13,10,10,20,21,25,8
795 DATA 7,-6,10,-10,30,6,-19,22,-2
800 DATA 9,10,7,-5,-20,12,21,18,7
805 DATA 7,8,5,-6,-40,3,16,-14,4
810 DATA 8,6,4,-4,40,8,4,-12,3
815 DATA 6,4,3,3,-15,5,8,-8,5
820 DATA 5,7,-1,-3,45,6,-10,10,4
825 DATA -2,6,-3,-8,-20,7,10,14,6
830 DATA 11,11,-5,-7,30,10,-11,-18,-4
835 DATA -5,13,-8,6,25,4,18,-22,-4
840 DATA -8,-10,-10,-15,-20,-20,-23,-25,-7
845 CLS:PRINT@20,"GAME INSTRUCTIONS":PRINT:PRINT
850 PRINT"THE OBJECT OF THE GAME IS TO SHREWDLY INVEST $5000 IN THE GAME'S"
855 PRINT"TEN SECURITIES, BUYING AND SELLING EACH YEAR IN AN ATTEMPT TO"
860 PRINT"BECOME THE WEALTHIEST PLAYER.  EACH YEAR, ALL PLAYERS RECEIVE"
865 PRINT"DIVIDENDS ON EVERY PAYING STOCK WORTH $50 OR MORE.  AT THAT TIME"
870 PRINT"EACH PLAYER GETS A CHANCE TO SELL ANY STOCK HE OWNS OR BUY ANY"
875 PRINT"STOCK HE WANTS.":PRINT
880 PRINT"THE PLAYER MUST HAVE ENOUGH MONEY TO PURCHASE THE STOCKS INDICATED,"
885 PRINT"AND MUST ACTUALLY OWN THE STOCKS BEING SOLD.  IF NOT, AN ERROR"
890 PRINT"MESSAGE IS DISPLAYED AND THE PLAYER MUST RE-ENTER THE TRANSACTION."
895 PRINT"AS EACH TRANSACTION IS COMPLETED, THE TABLE IS UPDATED TO SHOW THE"
900 PRINT"PLAYER'S NEW HOLDINGS AND CASH ON HAND.  WHEN ALL PLAYER'S HAVE"
905 PRINT"COMPLETED THEIR TRANSACTIONS, THE NEXT YEAR'S VALUES ARE COMPUTED"
910 PRINT"AND THE GAME CONTINUES.":PRINT
915 PRINT"AT THE END OF TEN YEARS, EACH PLAYER'S NET WORTH IS CALCULATED AND"
920 PRINT"THE WEALTHIEST PLAYER WINS!":PRINT
925 INPUT"WHEN READY TO CONTINUE, DEPRESS <ENTER>";Q$
930 PRINT"IF THE VALUE OF ANY STOCK FALLS TO ZERO, THAT STOCK GOES BANKRUPT,"
935 PRINT"AND ALL SHARES ARE SURRENDERED.  THE VALUE IS THEN RE-ESTABLISHED"
940 PRINT"AT $100.  IF THE VALUE REACHES $150, STOCKS WILL SPLIT AND ANY PLAYER'
S"
945 PRINT"OWNING SHARES WILL RECEIVE THE ADDED SHARES.  WHEN SPLITTING, THE"
950 PRINT"VALUE OF THE STOCK IS HALVED AND ROUNDED UP TO THE NEXT DOLLAR."
955 PRINT"THE TABLES PRINTED EACH YEAR GIVE THE YEAR NUMBER, THE TYPE OF"
960 PRINT"MARKET (BULL OR BEAR), THE CHANGE IN VALUE OF EACH STOCK (+/-),"
965 PRINT"THE CURRENT PRICE, AND THE NUMBER OF SHARES EACH PLAYER OWNS OF ALL"
970 PRINT"STOCKS.  ANY DIVIDENDS RECEIVED FOR THE YEAR WILL BE SHOWN ALONG WITH"
975 PRINT"EACH PLAYER'S TOTAL CASH ON HAND.":PRINT:PRINT
980 FORTM=1TO11:PRINT:NEXTTM
985 INPUT"WHEN READY TO CONTINUE, DEPRESS <ENTER>";Q$
990 PRINT"THE AVAILABLE SECURITIES AND THEIR RESPECTIVE DIVIDENDS PER SHARE ARE"
995 PRINT"AS FOLLOWS:":PRINT
1000 PRINT"ABBREVIATION";TAB(15)"SECURITY NAME";TAB(45)"DIV./SHARE"
1005 PRINT"------------";TAB(15)"--------------";TAB(45)"----------"
1010 PRINT"HIB";TAB(15)"HIGHWAY IMPROVEMENT BONDS";TAB(45)"$5"
1015 PRINT"XP";TAB(15)"X-PANDO CORPORATION";TAB(45)"$1"
1020 PRINT"SP";TAB(15)"SEASIDE PROPERTIES INC.";TAB(45)"NONE"
1025 PRINT"ODM";TAB(15)"OLD DOG MUTUAL FUNDS";TAB(45)"$4"
1030 PRINT"RD";TAB(15)"RUBBLE DEVELOPMENT";TAB(45)"$7"
1035 PRINT"SO";TAB(15)"SLIPPERY OIL COMPANY";TAB(45)"NONE"
1040 PRINT"BT";TAB(15)"BUMPY TRANSPORTATION";TAB(45)"NONE"
1045 PRINT"KA";TAB(15)"KRASH AUTO COMPANY";TAB(45)"$2"
1050 PRINT"ZE";TAB(15)"ZAP ELECTRONICS";TAB(45)"$6"
1055 PRINT"BPL";TAB(15)"BLINKEY POWER & LIGHT";TAB(45)"$6"
1060 FORTM=1TO10:PRINT:NEXTTM
1065 PRINT:INPUT"WHEN READY TO PLAY, DEPRESS <ENTER>";Q$:CLS:GOTO25
```

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Totals	1:02:30 hrs.	13:50:08 hrs.

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FUN HOUSE

by Richard Ramella

Selected Short Subjects

As you left the Fun House last month, a big crate arrived bearing the label *Material for July Fun House.* Inside was a smaller crate. Inside that was a box, then another box, and so on until I came to a tiny, jewel-encrusted treasure chest. Inside that chest were the very short programs I'll run this month.

Welcome to the Fun House Festival of Miniature Programs. The longest program, the giant of the month, so to speak, is fewer than 70 lines long.

We're having this festival because of the letters I've received from kids and other people who know how to have fun. These letters say that lots of you want short programs.

Here are some of the reasons: Shorties are easy to enter and provide quick results without much frustration. They give Fun House visitors ideas for other programs.

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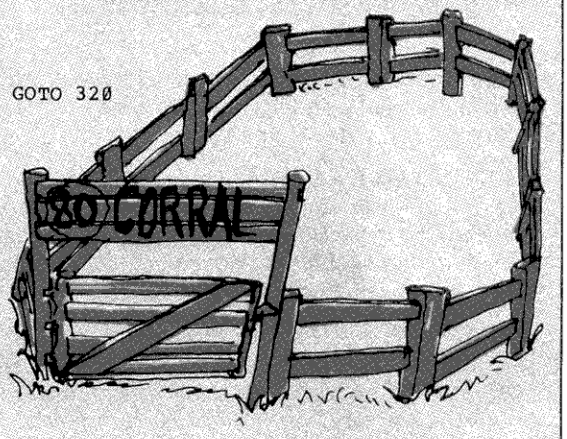
```
100 REM * CORRAL * TRS-00 LEVEL II BASIC / RAMELLA
110 REM * FUN HOUSE / JULY / SELECTED SHORT SUBJECTS
120 CLS
130 PRINT "CORRAL..."
140 PRINT
150 PRINT "ARE YOU..."
160 PRINT "<1> A TENDERFOOT?"
170 PRINT "<2> A HIRED HAND?"
180 PRINT "<3> AN EXPERT WRANGLER?"
190 PRINT
200 INPUT X
210 IF X<>1 AND X<>2 AND X<>3 THEN CLS: GOSUB 750: GOTO 140
220 CLS
230 V=500
240 IF X=1 THEN W=20
250 IF X=2 THEN W=10
260 IF X=3 THEN W=2
270 Y=0
280 FOR X=0 TO 20
290 SET(X,Y)
300 IF X>9 AND X<12 GOTO 320
310 SET(X,Y+20)
320 NEXT X
330 X=0
340 FOR Y=0 TO 20
350 SET(X,Y)
360 SET(X+20,Y)
370 NEXT Y
380 A=10
390 B=5
400 X=11
410 Y=18
420 SET(A,B)
430 SET(X,Y)
440 A$=INKEY$
450 N=N+1
460 RESET(X,Y)
470 RESET(A,B)
480 IF A$="L" AND X-1<>0 THEN X=X-1
490 IF A$="R" AND X+1<>20 THEN X=X+1
500 IF A$="D" AND Y+1<>20 THEN Y=Y+1
510 IF A$="U" AND -1<>0 THEN ELSEY-1
520 SET(X,Y)
530 RESET(A,B)
540 IF POINT(A-1,B)=-1 THEN A=A+1
550 IF POINT(A+1,B)=-1 THEN A=A-1
560 IF POINT(A,B-1)=-1 THEN B=B+1
570 IF POINT(A,B+1)=-1 THEN B=B-1
580 IF B>20 THEN PRINT "YOU DID IT": GOTO 730
590 N=N+1
600 IF N<W GOTO 680
610 RESET(A,B)
620 C=RND(4)
630 IF C=1 THEN A=A+1
640 IF C=2 THEN A=A-1
650 IF C=3 THEN B=B-1
660 IF C=4 THEN B=B+1
670 N=0
```



Listing continues

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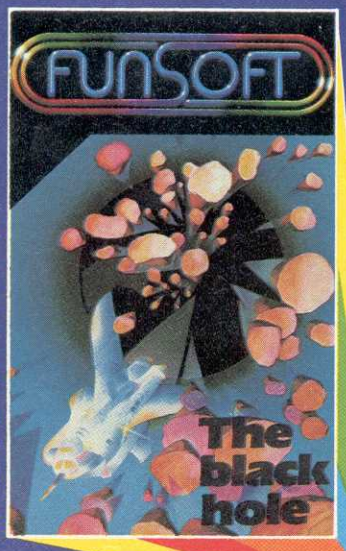

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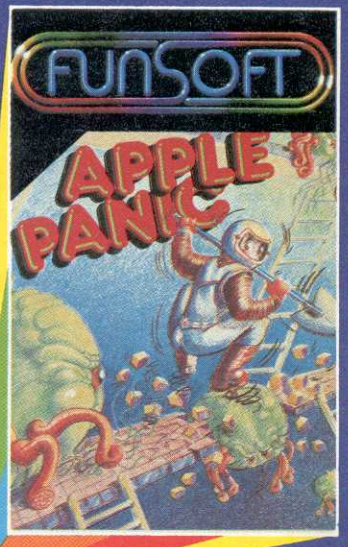

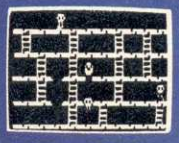

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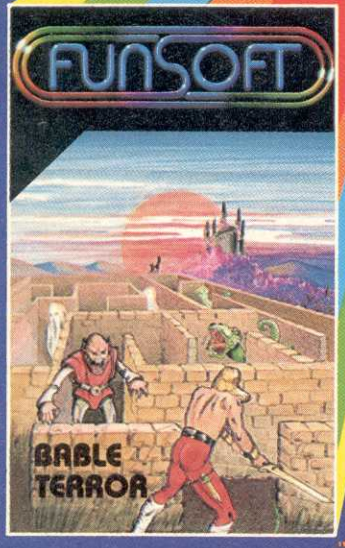

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Also, a short program is an honest little event. It says what it has to say and that's it. The beginning programmer can work through the logic of the program because it uses single-statement lines and lots of spaces.

This month we have Oxo, which is a puzzle, and Flash Math, an addition game that tests your brain and your eyes. These listings work for Level II and Color Basic.

A graphics game called Corral comes in two versions: Color Basic and Level II. Kaleidoscope is a very short program that has a few surprises. You Color Computer fans get the best version, but I include a Level II listing also.

Corral

Out back of the Fun House is a genuine western corral, a fenced area. Inside the corral is a pony named Pete. You can go for a ride on Pete. . . if you can get him outside the corral.

First, you're asked your skill level. Enter the number 1 if

Listing continued

```
680 SET(A,B)
690 V=V-1
700 PRINT @ 960,V;"  ";
710 IF V=0 THEN PRINT "NO POINTS": FOR T=1 TO 1000: NEXT T: CLS:
 GOTO 120
720 GOTO 440
730 SET(A,B)
740 GOTO 740
750 PRINT "ENTER 1, 2 OR 3, PARTNER..."
760 FOR T=1 TO 1000
770 NEXT
780 RETURN
790 END
```

Corral — Color Basic

```
100 REM * CORRAL * TRS-80 COLOR BASIC 4K / RAMELLA
110 REM * FUN HOUSE / JULY / SELECTED SHORT SUBJECTS
120 CLS
130 PRINT "CORRAL..."
140 PRINT
150 PRINT "ARE YOU..."
160 PRINT "<1> A TENDERFOOT?"
170 PRINT "<2> A HIRED HAND?"
180 PRINT "<3> AN EXPERT WRANGLER?"
190 PRINT
200 INPUT X
210 IF X<>1 AND X<>2 AND X<>3 GOSUB 760: GOTO 140
220 CLS0
230 V=500
240 IF X=1 THEN W=20
250 IF X=2 THEN W=10
260 IF X=3 THEN W=2
270 Y=0
280 FOR X=0 TO 20
290 SET(X,Y,5)
300 IF X>9 AND X<12 GOTO 320
310 SET(X,Y+20,5)
320 NEXTX
330 X=0
340 FOR Y=0 TO 20
350 SET(X,Y,5)
360 SET(X+20,Y,5)
370 NEXT Y
380 A=10
390 B=5
400 X=11
410 Y=18
420 SET(A,B,8)
430 SET(X,Y,7)
440 A$=INKEY$
450 N=N+1
460 RESET(X,Y)
470 RESET(A,B)
480 IF A$="L" AND X-1<>0 THEN X=X-1
490 IF A$="R" AND X+1<>20 THEN X=X+1
500 IF A$="D" AND Y+1<>20 THEN Y=Y+1
510 IF A$="U" AND Y-1<>0 THEN Y=Y-1
520 SET(X,Y,7)
530 RESET(A,B)
540 IF POINT(A-1,B)<>0 THEN A=A+1
550 IF POINT(A+1,B)<>0 THEN A=A-1
560 IF POINT(A,B-1)<>0 THEN B=B+1
570 IF POINT(A,B+1)<>0 THEN B=B-1
580 IF B>20 THEN PRINT "YOU DID IT.": GOTO 730
590 N=N+1
600 IF N<W GOTO 680
610 RESET(A,B)
620 C=RND(4)
630 IF C=1 THEN A=A+1
640 IF C=2 THEN A=A-1
650 IF C=3 THEN B=B-1
660 IF C=4 THEN B=B+1
670 N=0
680 SET(A,B,8)
690 V=V-1
700 PRINT @ 448,V;"  ";
710 IF V=0 THEN PRINT "NO POINTS": FOR T=1 TO 1000: NEXT T: CLS0
:GOTO 120
720 GOTO 440
730 SET(A,B,RND(8))
```

Listing continues

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Listing continued

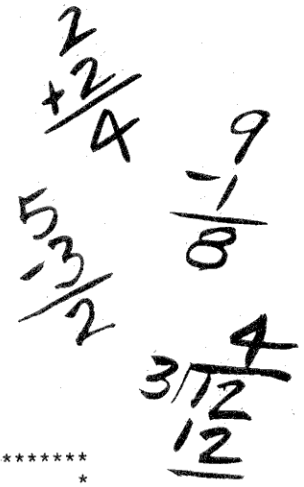
```
740 SOUND RND(8)*13,1
750 GOTO 730
760 CLS
770 PRINT "ENTER 1, 2 OR 3, PARTNER..."
780 FOR T=1 TO 1000
790 NEXT
800 RETURN
```

Oxo

```
100 REM * OXO * TRS-80 LEVEL II AND COLOR BASIC / RAMELLA
110 REM * FUN HOUSE / JULY / SELECTED SHORT SUBJECTS
120 CLS
130 A$(1)="O"
140 A$(2)="X"
150 A$(3)="O"
160 PRINT A$(1);A$(2);A$(3)
170 FOR T=1 TO 3
180 PRINT
190 PRINT"123"
200 PRINT
210 PRINT "TURN"T
220 INPUT "ENTER 2 NUMBERS SEPARATED BY COMMAS";C,D
230 IF C>3 OR D>3 OR C=D THEN 220ELSE IF C<>1 AND C<>2 AND C<>3
AND D<>1 AND D<>2 AND D<>3 THEN 220
240 IF A$(D)="X" THEN A$(D)="O" ELSE IF A$(D)="O" THEN A$(D)="X"
250 IF A$(C)="X" THEN A$(C)="O" ELSE IF A$(C)="O" THEN A$(C)="X"
260 CLS
270 PRINT A$(1);A$(2);A$(3)
280 IF A$(1)=A$(2) AND A$(3)=A$(1) GOTO 310
290 NEXT T
300 PRINT @ 448,"3 TRIES UP. TRY AGAIN?": END
310 IF T<3 THEN PRINT @ 448,"TOO QUICK. DO IT IN EXACTLY THREE M
OVES. TRY AGAIN?": END
320 PRINT @ 448,"VERY GOOD. 3 MOVES AND COMPLETE."
330 END
```

Flash Math

```
100 REM * FLASH MATH * TRS-80 LEVEL II AND COLOR BASIC / RAMELLA
110 REM * SEE COLOR CHANGES AT BOTTOM...
120 G=200
130 CLS
140 A=RND(20)
150 B=RND(20)
160 PRINT @ RND(15)*64+RND(50),A"+"B
170 FOR T=1 TO G
180 NEXT T
190 CLS
200 G=G-5
210 IF G<50 THEN G=50
220 INPUT "ANSWER";C
230 PRINT
240 IF C=A+B THEN PRINT "RIGHT.": P=P+1
250 PRINT
260 PRINT "SCORE"P
270 IF C<>A+B THEN 310
280 FOR T=1 TO 500
290 NEXT T
300 GOTO 130
310 PRINT "YOU SAID"C"BUT"A"+"B"="A+B"."
320 PRINT "GAME OVER. WHY NOT TRY AGAIN?"
330 END
340 REM ****************************************
350 REM *     CHANGES FOR COLOR BASIC          *
360 REM * 120 G=300                            *
370 REM * 160 PRINT @ RND(15)*32+RND(23),A"+"B *
380 REM ****************************************
```



you're a tenderfoot, 2 if you're a hired hand, and 3 if you're an expert wrangler. Your skill level determines how fast Pete runs.

When the game starts, you are the blip at the bottom of the corral near the entrance, and Pete is the blip at the top. Use the keys L for left, R for right, U for up, and D for down to get yourself between Pete and the corral gate at the bottom.

You drive Pete in any direction by putting yourself on the opposite side of him and moving toward him.

The number 500 is at bottom screen left. To win that free ride, drive Pete through the corral gate before the number reaches zero. See the separate Color and Level II listings.

Move 'em out, partner!

Oxo

Oxo is a puzzle for computer experts from about four to seven years old. The listing works in Level II and on color machines.

The word OXO appears on the screen with the numbers 1, 2, and 3 beneath. The player has three turns—no more, no less—to change OXO into either XXX or OOO.

On each turn the player must choose two numbers out of 1, 2, and 3. The letters above the chosen numbers then change. An X becomes an O, and an O becomes an X. That's all there is to it, but it's a fine puzzle for its intended audience.

Flash Math

Think you're smart? I think so too. Flash Math presents fairly easy addition problems. It goes as high as 20 plus 20.

You get to keep playing and increasing your score as long as you get the right answers. If that were all, it would be simple and not much fun, but the program does more.

The problem can appear anywhere on the screen. And every

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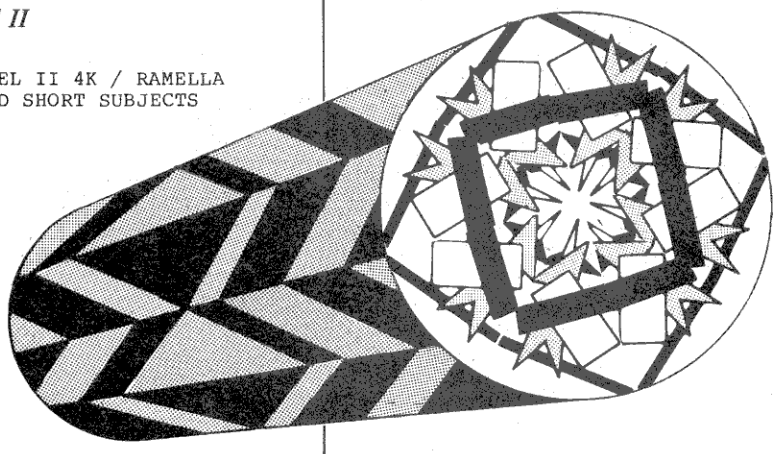
Kaleidoscope — Level II

```
100 REM * KALEIDOSCOPE * TRS-80 LEVEL II 4K / RAMELLA
110 REM *FUN HOUSE / JULY / SELECTED SHORT SUBJECTS
120 CLS
130 A=RND(14)*64
140 B=RND(30)
150 C=RND(2)
160 IF C=1 THEN W=128 ELSE W=191
170 Z$=CHR$(W)+CHR$(W)
180 PRINT @ A+B,Z$;
190 PRINT @ A+62-B,Z$;
200 PRINT @ 960-A+B,Z$;
210 PRINT @ 960-A+62-B,Z$;
220 A$=INKEY$
230 IF A$="E" GOTO 120
240 IF A$="F" GOTO 260
250 GOTO 130
260 A$=INKEY$
270 IF A$="" GOTO 260 ELSE GOTO 130
280 END
```



Kaleidoscope — Color Basic

```
100 REM * KALEIDOSCOPE * TRS-80 COLOR BASIC 4K / RAMELLA
110 REM * FUN HOUSE / JULY / SELECTED SHORT SUBJECTS
120 CLS0
130 A=RND(14)*32
140 B=RND(15)
150 Z$=CHR$(143+RND(7)*16)
160 PRINT @ A+B,Z$;
170 PRINT @ A+31-B,Z$;
180 PRINT @ 448-A+B,Z$;
190 PRINT @ 448-A+31-B,Z$;
200 A$=INKEY$
210 IF A$="E" GOTO 120
220 IF A$="F" GOTO 240
230 GOTO 130
240 A$=INKEY$
250 IF A$="" GOTO 240 ELSE GOTO 130
260 END
```

math problem remains on the screen for a little less time than the problem before. Toward the end, if you haven't made a mistake, the problems make truly split-second appearances.

I doubt if anyone can even see the problem at its shortest appearance, but don't let that stop you from trying.

Only one listing is given here. Level II computer whizzes should stop typing with line 330 END. Color Computer players should type in the program as given, and then type the new lines at the bottom of the listing. See them in lines 360 and 370?

Kaleidoscope

You might think a kaleidoscope program without color is like watching a black-and-white movie of a rainbow. Not quite. Since we can see only two things—light or no light—the Level II Kaleidoscope provides a constantly changing pattern.

In Level II and Color Basic listings, tap the letter E to erase the screen and start a new pattern. To freeze a pattern tap F, and to unfreeze the pattern and continue, tap any key except shift or break.

I have several line changes that give different results. Generally, you should make only one change and then see what happens. Later, you might try mixing them.

```
120 CLS (RND(8))
150 Z$=CHR$(143+(RND(2)*16)
150 Z$=CHR$(143+RND(2)+2*16)
195 SOUND A/2,1
225 CLS0
```

The last is my favorite. I suggest you watch for a minute or two to see if you get hooked by it:

```
150 Z$=CHR$(143+(RND(2)+5)*16)
```

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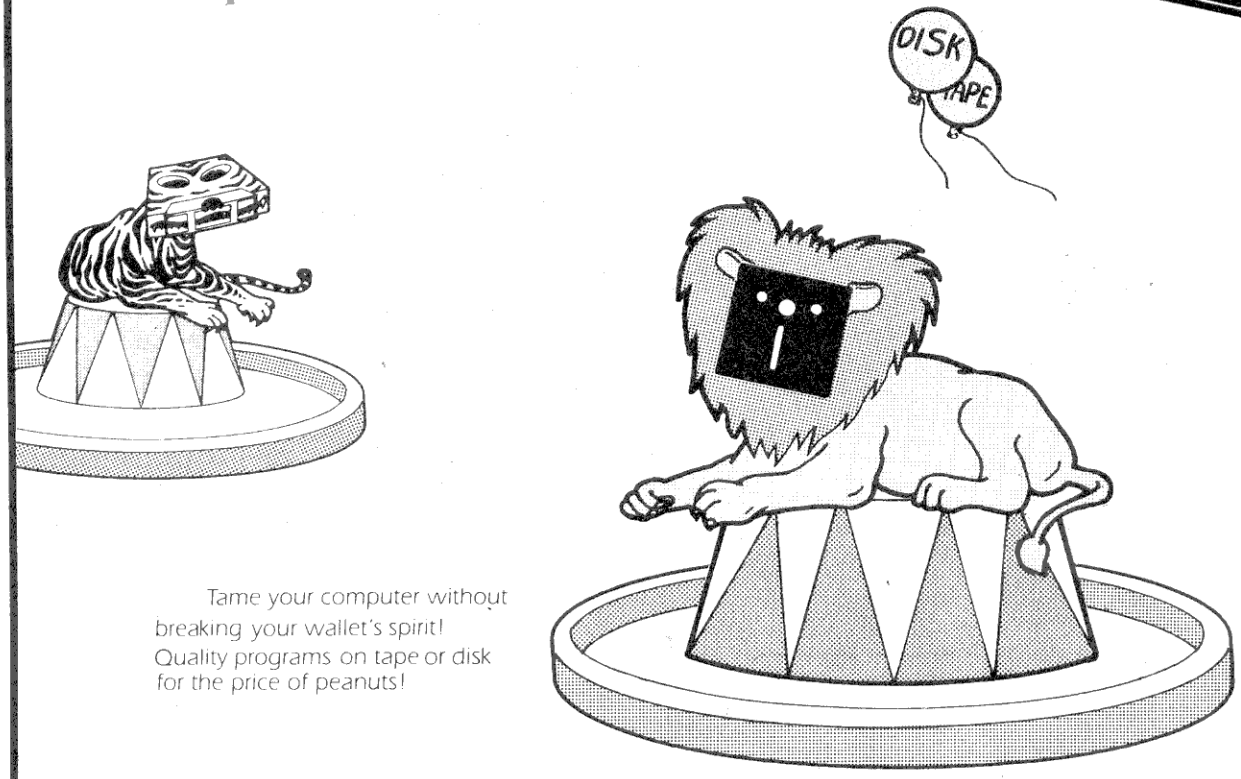

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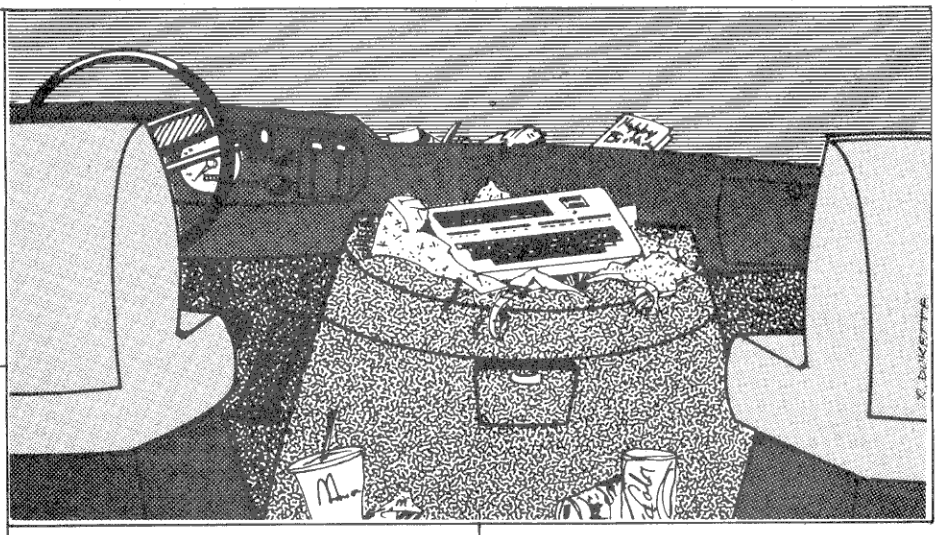
The GAMER'S CAFE

by Mercedes Silver

Mercedes writes home



Dear Daddy,

Thank you so much for the Model 100! It was sweet of you to remember my birthday, even though I couldn't be with you and Mommy in Baltimore. The guys and I have been dying to get one. I know you're back-ordered on them at the store.

Mad Max wouldn't let me take it apart and tinker right away. I had to write patches for him to play games on it, but I haven't done much work with CMOS RAMs yet and probably did a crummy job. Vertical games like Cosmic Fighter are a little crowded, but horizontal ones like Penetrator look all right.

I am *fine* and there is nothing to worry about. Rodney stopped hallucinating as soon as we got something to eat, and we're fine now. The check from *80 Micro* finally came for the January and February columns, and I sold my Air Supply albums to a girl in Beckley, WV. Max always rolled his eyes and pretended he was going to be sick when I played them anyway.

Also, the Cafe started doing well. I had to do a project for my Real World I/O course, so I rigged a relay to a bunch of games that tips a chair and dumps Max into a barrel of water when you hit 100,000. Mad Max is a proud man—an austere one, really—and the fact that he's willing to do this to help Rodney just shows the kind of loyalty we have to one another. These people are my friends.

* * * * *

It's a little later now. We had a really slow day in Knoxville, TN; Rodney kept asking "Where are the crowds? Where's the World's Fair?" and tried to cash a check at the United American Bank.

"Did you know 'Heartbreak Hotel' was co-written by Hoyt Axton's mother?" Max read. He dragged us all to the Grand Ole Opry in Nashville last night and spent the day humming over his souvenir program.

I went through about a ton of mail for the scoreboard. A lot of people send scores that are too low by the time the magazine with the old record comes out, but everybody is very cheerful: "Hey Mad Max, I read that the high score for Sea Dragon was only 147,910. I think it's time for that record to fall...I wish to tell you that I got 178,350 points. I don't lie, so please take my word for it. My name is Mike Beebe, and I live in Sacramento, CA (yea!)."

"Michael James David Beebe," read Max. "Too bad somebody sent in—"

"552,890 points, John Hope, Kingston, Ontario," said Rodney, the Human Data Base.

"—before he wrote," Max finished. "Sounds like an okay guy, for Sacramento."

* * * * *

What I wish, really, is that the customers here on the road were as nice as the readers. H.J. Nielsen Jr. of Conyers, GA ("I have been accused of using Superzap on my scores") sent the last comment on Galaxy Invasion: "The point of this letter is to ask you to knock it off with the '1 million, six ships left, and bored.' Let me know when you can go for coffee and still have ships going behind the score."

On the other hand, Patrick Kellogg of White Bear Lake, MN thinks scores are too high: "How can you compete with someone who 'had six ships but got bored'?...When your column first came out, I thought it was great. But now it's just depressing."

"Hear, hear," muttered Rodney. "Seems like 10 years since Winthrop and I left Boston last fall."

* * * * *

We usually give people tips, but this month we're happy to receive some: two adventurers wrote with help for Quest for the Key of Nightshade (*80 Micro*, February 1983, p. 85).

Eugene Ulrich of Philadelphia had trouble with OV errors when trying to go beyond Skill Level 1 on his Model I. He fixed things by changing the value of J in three lines: in lines 2520 and 2550 to J = RND(N*200) + N*100, and in line 2620 to J = RND(N*200) + N*75.

As for strategy, while Eugene travels light with leather or no armor, Chris Lampton (Hyattsville, MD) advises hiring seven warriors and giving them chain mail. Both recommend getting to a town and buying supplies as quickly as possible, and caution against traveling more than one square over water.

When declining to fight, says Eugene, don't hold down the N key too long lest the computer interpret that as a move north. Chris likes to burglarize castles several times before attacking, even if it means repeated trips to town to hire burglars.

Finally, both recommend a modest skill level. Eugene believes level 20 is impossible, unless you resort to an "act of desperation"—line 170, G = G + 350,000.

* * * * *

Philip MacKenzie wrote from Trend Software Co., asking us to plug a couple of new games—Stronghold, a two-player arcader similar to Warlords, and Convoy, with "more action-packed graphics than any other TRS-80 game, over 25 different aliens, and virtually no flickering." Probably a rebuttal

The Big Board

Alien Defense	91,320	Carl Pflanzer, Gillette, NJ
Armored Patrol	81,000*	Winthrop
Astro Blast (CC)	15,225	Andrew Puglise, Aliquippa, PA
Attack Force	996,310	Kevin Bolduan, Lake Oswego, OR
Bable Terror	7,858	Mad Max
Bounceoids	2,028,450	Scott McClure, Winter Park, FL
Caterpillar	237,800	Ron Coleman, Jacksonville, FL
Chicken	8,922	Halfdan Hansen, Nelson, N.Z.
Cosmic Fighter	581,280	L. Ken Jackway, Phoenix, AZ
Cyborg	99,960	George Heineman, Framingham, MA
Defense Command	126,170	Bette Dufraine, Bolton, CT
Demon Seed	94,210	Philip MacKenzie, Bloomfield Hills, MI
Dig Out	194,100	Ron Coleman, Jacksonville, FL
Donkey King (CC)	74,800	Richard Uglum, Milwaukee, WI
Eliminator	271,300	Dean Mitchell, Edmonton, Alta.
Flying Saucer	1,270**	James Oh, Pebble Beach, CA
Fortress	187,600	Mark Brinkman, Emporia, KS
Frogger	16,080	Philip MacKenzie, Bloomfield Hills, MI
Galactic Attack (CC)	41,340	Rich Fiore, Clemson, SC
Galaxy Invasion	7,185,230+	James & Richard Oh, Pebble Beach, CA
Galaxy Invasion Plus	1,113,600	Geordon Portice, Twining, MI
Ghost Hunter	41,190	John Kane, Nelson, N.Z.
Jovian	133,320	Mark Brinkman, Emporia, KS
Laserball	72,530	Neil Matson, Panama City, FL
Laser Defense	246,910	George Heineman, Framingham, MA
Liberator	417,300	Patrick Kellogg, White Bear Lake, MN
Lunar Lander	9,600	Nelson Kruger, Duarte, CA
Meteor Mission 2	100,780	Mike Bolduan, Lake Oswego, OR
Meteoroids (CC)	25,270	Andrew Puglise, Aliquippa, PA
Microbes (CC)	69,400++	Rich Fiore, Clemson, SC
Missile Attack	41,430	John Kane, Nelson, N.Z.
Monkey Kong (CC)	746	Andrew Puglise, Aliquippa, PA
Monster Maze (CC)	14,340	Rich Fiore, Clemson, SC
Outhouse	27,759	Philip MacKenzie, Bloomfield Hills, MI
Pac Attack (CC)	56,235	Andy Lehtola, Mound, MN
Paddle Pinball	861,680	James Oh, Pebble Beach, CA
Panik	36,920	David Sanderman, Lomita, CA
Penetrator	345,510	George Heineman, Framingham, MA
Planet Invasion (CC)	57,500	Andrew Puglise, Aliquippa, PA
Polaris (CC)	53,879	Rich Fiore, Clemson, SC
Poltergeist (CC)	4,840	Rich Fiore, Clemson, SC
Robot Attack	19,210	Mike Bolduan, Lake Oswego, OR
Scarfman	336,220	Jack Martin, Somis, CA
Sea Dragon	552,890	John Hope, Kingston, Ont.
Space Castle	37,650	Mark Brinkman, Emporia, KS
Space Intruders	4,515	Philip MacKenzie, Bloomfield Hills, MI
Space Warp (Level 8)	261	Jer McLanahan, New Canaan, CT
Stellar Escort	53,350	Geordon Portice, Twining, MI
Storm (CC)	170,775	Andrew Puglise, Aliquippa, PA
Super Nova	1,166,340	Mark Brinkman, Emporia, KS
Swamp Wars	39,200	Winthrop
Time Runner	89,479	Mad Max

*Mohan Ramaswamy (Altamonte Springs, FL) reports 368,000. He doesn't say whether it was Method I or II.

**Played at the highest level.

+Solo record: 2,026,850 (Nelson Kruger, Duarte, CA).

++Level 6.

Gamer's Cafe readers are invited to submit their high scores, for these and other TRS-80 games. We'll print unvalidated scores, but validated ones (a photo of the screen) will, of course, rank higher in prestige.

to people who said Demon Seed looked epileptic.

Speaking of Demon Seed, whoever scores over 94,210 is going to get tons of prestige. That's MacKenzie's score—the first Big Board entry by a game author.

"Co-author," Max interrupts. "Like 'Heartbreak Hotel.' "

"Hoyt Axton's mother wrote Demon Seed?" Rodney inquires. "I thought that was MacKenzie and Jeffrey Sorensen."

"No, they wrote 'Great Balls of Fire,' " says Max. "Attack Force was done by Jerry Lee Lewis on the old Sun Records label." (These guys think they're very funny. I think people who look over other people's shoulders when they're writing letters are *rude*.)

* * * * *

It was nice of Prof. Brookstone at Johns Hopkins to write about the people from Apparat and Logical Systems and Micro-Systems Software tearing their hair when they saw SilverDOS. I guess that means I'll get the master's. I'm not doing anything ambitious now, just finishing SilverScripsit and Silver Utility Plus; I made one version that was so protected even I couldn't back it up, and then I found a bug in it and had to start over.

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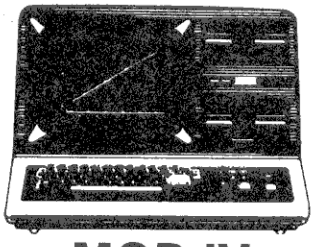

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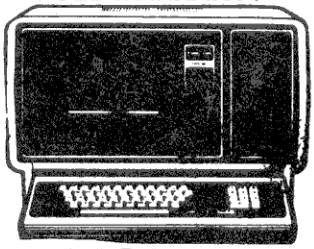

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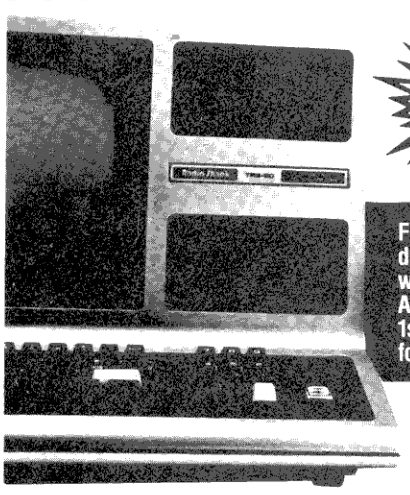

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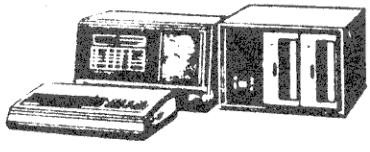

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by Terry Kepner

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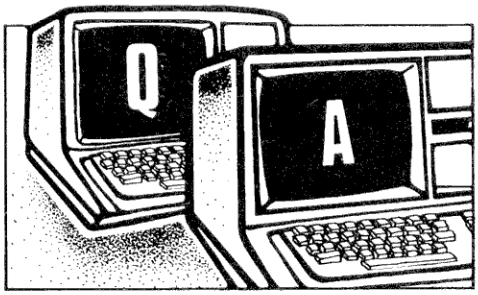

I had the same problem that T.R. of Weslaco, TX had, where the back-up/copy under NEWDOS80 resulted in a motor-too-slow error followed by failure in format routine (February 1983, p. 410). I solved it by using a small fine-grain file to clean the contacts on the TRS-80 flat connector and the disk-drive cable attached to it. The problem is due to a missing signal rather than a disk-drive fault.

A.S.
Maitland, FL

Do you mean that the drive cable wasn't picking up a signal when it should have been? Or that the signal just isn't there? It's ambiguous, but it sounds as if you're saying the cable/drive connection was at fault. In either case, if all other solutions have failed, try A.S.'s solution.

I have a Model I with double density installed by Radio Shack. I have a problem exiting from Scripsit while in the double-density mode. When I type END and press enter, the system has to be rebooted to get to TRSDOS.

I called Radio Shack and they informed me that they don't support any of their programs under their double-density system. I've also had a problem getting VisiCalc to print with my LP VI. I found out that I can't use the LPC/CMD with this program in double-density. Do you have a solution?

J.R.
Geary, OK

I was most disappointed when I heard that Radio Shack wouldn't support their software with their double-density modification. LPC/CMD won't work with it because it tries to use the same memory locations as TRSDOS 2.7D. Similarly, the exit vector used by Scripsit to return to TRSDOS is not the same address used by TRSDOS 2.7D.

The only permanent solution I know of is to switch to a DOS that supports both the Radio Shack double-density board and Radio Shack's programs. MULTIDOS, DOSPLUS, and LDOS all do this.

Does anyone know of a patch to fix these programs to work with TRSDOS double density? If so, let me know.

The answer to S.G. of Miami, FL (February 1983, p. 408), about the inventory control program is that there are some LPRINT" " and LPRINTs that don't belong in the program. The LPRINT" "s should be changed to LPRINT. He should look for an LPRINT where there shouldn't be one and drop it. I think it's located either just ahead of the line that prints the string of dashes or at the end near the pagination code. The LPRINT" " causes misalignment at the header and with the column titles.

P.E.
Newark, DE

That works only if your printer actually LPRINTs when it receives an LPRINT without a quoted space. Many of the earlier printers require a space after an LPRINT before they'll respond to the LPRINT.

I'm writing in response to H.L. of South Bend, IN (March 1983, p. 414). He has the same problem that I've had for the past six months: a small ripple traveling from the bottom to the top of the video display. It seems to be noise coming in over the ac house wiring. I'm in the process of gathering parts to construct an EMI/RFI ac filter.

I'm building my filter the same way as Paul Fowler outlined in his "Lightning Strikes Twice" article (July 1981, p. 184). The only difference is that I'm using Radio Shack's new EMI/RFI filter (273-100) and I'm omitting the transient surge absorber since it causes erratic system operation. The last part I have to locate is the ac socket Waber #3015.

S.M.
Port Richey, FL

Good luck, and be sure to let us know if your filter eliminates the ripple.

Approximately a year ago lightning hit near my home. My Model I screen blinked, and garbage appeared on the screen. I turned the computer off and when I turned it back on, everything worked fine. Recently, I tried to load some machine-language programs, such as T-Bug and EDTASM. They loaded, but when I ran them the screen cleared and the Memory Size? prompt appeared. The programs are in memory (I PEEKed at them), and my 16K memory is good as far as I can tell.

I'd like to repair my TRS-80 myself, if I can. Would you advise me on how to check the ROMs and the memory?

B.C.
Nokomis, FL

Before digging into your computer, check your tape recorder. It could be that your tape heads are either dirty, out of alignment, or failing due to age. Borrow a new one and see if the programs load and execute. A new tape recorder might solve your complaint.

Similarly, check the tapes themselves for dimples or slight indentations that may be pulling the tape away from the tape head at the end of the programs. Because the computer turns off the tape motor immediately after the end of a program, part of the program is usually left trapped between the pinch roller and the post. Since the post is metal and the roller is rubber, the tape is pressed into the roller, creating a small depression. To relieve this pressure, press the stop button on your tape recorder. This pulls the pinch roller away from the metal post and frees the tape. Forgetting to do so and leaving the play button

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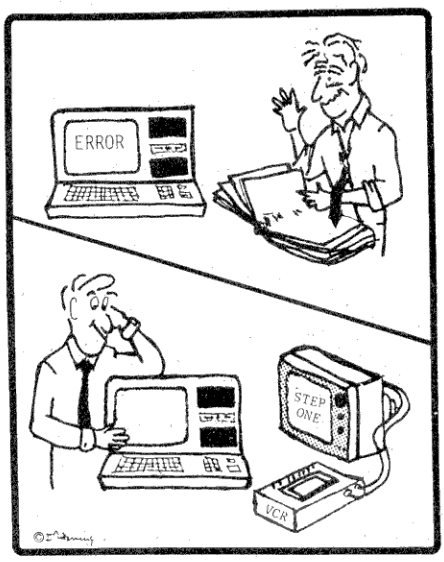

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down for long periods of time leads to permanent indentations in the tape at these places, thus preventing proper program loading. Check the other dumps of the programs on the tapes; perhaps they're O.K.

If the above doesn't apply, you may have a bad bit somewhere in your RAM. What makes it frustrating is that it's intermittent. Only the most comprehensive memory test will find the bad location. If you're in a hurry, buy eight new RAM chips (several manufacturers sell sets of eight for under $20) and replace the ones currently in your machine. Then test the programs to see if they'll load and work properly. If they do, you've solved your problem. If not, the problem is more technical.

First, get hold of the *TRS-80 Microcomputer Technical Reference Handbook* (Cat. No. 26-2103). This manual requires knowledge of electronics and expertise with a soldering iron. If you're willing to muck around with the insides of your Model I, you should be prepared for lots of work and frustration before you've solved the problem. If you're going to operate on the machine, I suggest you replace the CPU-to-keyboard cable with one more rugged and better soldered. The constant flexing of the cable while you work on the boards pulls the standard cable loose.

The technical manual is available either from a Radio Shack store or from National Parts (900 East Northside Drive, Fort Worth, TX 76102, 817-870-5662).

I notice you recommend that some sort of a line filter is a good idea. Since my Model III occasionally fades in and out with apparent voltage irregularities, I'm wondering how serious a problem this is. Your mention of several disasters has caused me to worry even more.

According to the Model III Technical Reference Manual, *"If a failure in the power supply causes the outputs to rise uncontrolled past a specified voltage, the power supply will automatically shut down." Is this statement incorrect or are your statements merely editorial advertising? If you're right, what type of filter do I need?*

D.B.
Lebanon, MO

Note that the operational statement in your quote is "If a failure in the power supply. . . ."

In almost every horror story I've heard about power problems, the fault was with the power supplied by the electric company and not with the computer's power supply.

The computer's power supply is a 120 V ac to 12, 5, and -5 volts dc converter. It has only enough regulation to convert the pulsating ac current to a stable dc current (±5 percent). It's not designed to stop extremely high voltages (at very low amperes) from entering the computer from the electricity supply. Neither is it designed to smooth out gross voltage fluctuations that take place over long periods of time (.001–2 seconds).

The power supply does, however, have a fuse that blows if too much current enters into the computer.

Unfortunately, lightning strikes introduce extremely high voltages at very low current rates into the electric company's power grid. When these get inside the computer, the voltage causes arcing between the various connections inside the microcomputer integrated circuits, because the components inside the ICs are so close together. Arcing is almost always destructive.

Voltage spikes are also caused by failing electric motors, arc-welding outfits, and similar heavy-duty electric equipment. The distance these spikes travel through a power grid is measured in miles, but fortunately is restricted to the particular branch of the grid where the spike originated.

Your complaint, fading video, is a power fluctuation. If the voltage drops below a predetermined level (usually 90 volts), the computer doesn't have enough power to operate reliably. This is a data-dangerous situation. If you happen to be accessing a disk at the time, and if you're lucky, you'll only destroy the file you're working on and not the entire directory. Voltage spikes are fairly easy to guard against. Many companies, including Radio Shack, sell voltage spike protection devices.

Protection against minor power fluctuations (between .001 and 1 second) is also available at a modest cost. For long-term undervoltage protection, you'll have to invest in a battery back-up power system. These, however, are expensive.

I have a solution to R.Z.'s problems with booting up his Model I (March 1983, p. 416). It may be a solution which I got from the Jessup Company (Box 33485, Seattle, WA 98133). It's called Drive-Life and is used on the head assembly rails of a disk drive, but it can also be used to clean the card edges on the Model I.

The Jessup Company suggests that two or three cleanings are necessary before you notice an improvement in the computer's operation. It took two before a significant improvement was made in mine, and after four I haven't had a single reboot in many hours of operation. The cleaner costs $5 for a rather small bottle, but it's well worth it.

S.T.
Visalia, CA

Sounds interesting. Has anyone else used it out there?

Your reply to R.Z. is good (March 1983, p. 416), but you might like to pass on my experience. My Model I behaved like R.Z.'s and I spent many hours checking pads, polishing and silvering contacts, and replacing plugs and cables. Nothing helped. Radio Shack examined the Expansion Interface unit for several weeks, but found nothing wrong. As a last resort, an independent technician replaced both the clock crystal and the disk controller IC which took care of the problems for eight months.

Looking back, it seems ridiculous that I had never cleaned the disk controller IC. Now, every three or four months when the problems return, I remove the disk controller chip, clean the pins with a pencil eraser and alcohol, and spray the socket with a contact cleaner. After doing this, all my problems are solved for months.

N.I.
Marlow, NH

I've never heard of anyone who had to clean the disk controller IC, but it seems obvious that it's worth a try. Just remember to be very careful about bending the pins when you insert the IC back in the socket; buying a new one isn't cheap.

Just often enough to be irritating, the MPI disk drive on my Model I goes into

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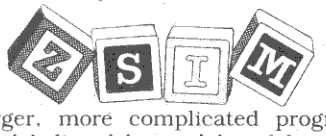

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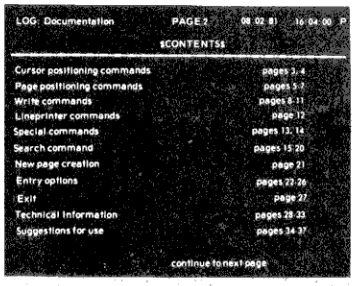

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a repetitive search mode instead of reading or writing to the disk. After rebooting, the system works fine for another hour or so. I've cleaned all the connections, the system passes memory tests, and the drives are within half an rpm of 300. I don't have line filters or isolation transformers, but then I haven't observed many line transients either. I installed the Percom data-separator board, but that doesn't seem to help.

G.E.
Tempe, AZ

See the previous two letters in this column for some ideas on controlling the problem, and also refer to the March 1983 Feedback Loop column for more discussion. You don't say, but I assume you don't have Gold Plug 80 replacement connectors. They can be purchased from the EAP Company (Box 14, Keller, TX 76248, 817-498-4242) at $18.95 for the CPU–EI set and at $54.95 for a complete set of six. If you're handy with a soldering iron, buy them. It'll improve your computer's performance.

In response to R.F.'s problem with Graftrax in his Epson printer (March 1983, p. 418), he sent out 14 spaces and expected 14 blank spaces to be printed. As far as the Graftrax was concerned, he sent out 14 CHR$(32)s (binary 00100000). Since one bit is on, one dot is printed. For the Graftrax, a space is CHR$(0). The following listing prints six dots after a 14-dot column space:

```
10  POKE 14312,27:POKE 1,1:POKE
14312,75:POKE 1,1:POKE 14312,20:POKE
1,1:POKE 14312,0:POKE 1,1
20  FOR X=1 TO 14:POKE 14312,0:POKE
1,1:NEXT X
30  FOR X=1 TO 6:POKE 14312,128:POKE
1,1:NEXT X
```

Instead of using the usual IF PEEK (14312)<>63 THEN method of waiting, I use POKE 1,1 which is shorter and provides enough of a delay for the printer. Notice that POKE 1,1 POKEs into ROM, which does nothing but waste a short period of time.

R.G.
North Hollywood, CA

Thanks for the information.

I use my Smith-Corona TP-1 printer with my Model III and SuperScripsit, and I've encountered a problem that I don't know how to correct. The first time I request a file to be printed, everything is underlined, even the margin spacing. By pressing break, answering No to the Continue prompt, and giving another print file command I can fix this.

Has anyone else had this problem and if so, is there a solution?

B.M.
Phoenix, AZ

I own a Model III and a TP-1 printer. Everything works fine except that the TP-1 goes into the underline mode whenever I print a document using SuperScripsit. By stopping and restarting the printing I can overcome this problem. I've also noticed that if I use the underline code set for a line, the unit seems to underline everything twice. I use the DWII printer driver and have no other problems.

J.K.M.
Erie, PA

I have a Model III with SuperScripsit and a SC TP-1. Everything works fine except that the second time I go to print out a document, the printer goes into an automatic underline mode (the first time is always fine). The third time I print a document, everything is back to normal.

According to the Smith-Corona manual, an ASCII "EM" (hex 19) toggles the automatic underlining mode of the printer on and off. Is there any way I can prevent this?

E.M.
New Orleans, LA

The problem, as E.M. has correctly ascertained, is the code used by SuperScripsit to initialize the DWII. This code clears the DWII buffer and prepares it for printing. Unfortunately this is the code used by the TP-1 to initiate underlining. For those of you whose printer underlines at the first print command, make the very first byte in your text file the code to turn off the underlining. After the first printing, alternate making that first line of the text file a comment line to conform to your needs.

A more permanent solution is to examine the DWII printer driver in the SuperScripsit manual, find the line of code that specifies the initialization character, and then using an Editor/Assembler, reassemble the DWII driver with the initialization code set to zero or some other innocuous code.

I'm astonished that more users aren't irate over Scripsit's horrible hyphenation system. This must be the most unusable hyphenation program in any

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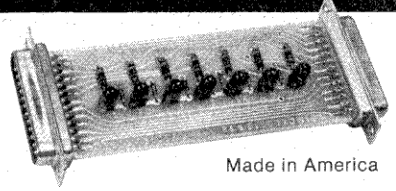

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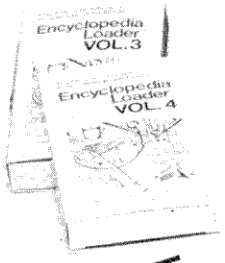

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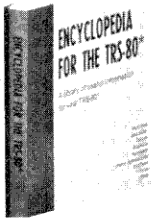

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word-processing software. Scripsit leaves huge blank spaces in the middle of the copy, frequently refuses to use all the available space on a line even though a perfectly acceptable syllable is available on the next line. I could understand this if hyphenation were programmed in, but Scripsit's system is theoretically supposed to allow the user to make the decision. Scripsit won't even let you justify your own copy. If you hyphenate a word on one line and try to delete a portion of it on the next line, Scripsit yanks the hyphenated part down to the line being worked on.

I'm not dissatisfied with Scripsit, I think it's a good program for $99, but prospective buyers should be warned about the hyphenation problem.

I put out a newsletter and use a 40-character column width. This tends to exaggerate Scripsit's weaknesses.

M.L.
Wichita, KS

As far as I know, Scripsit is the only TRS-80 word processor that tries to use hyphenation, but you're right, it doesn't work very well. You can, however, force the hyphenation by hand. Just put a space after the hyphen. This makes Scripsit treat the first part of the hyphenated word as a separate word. You didn't put a space after the hyphen, so Scripsit thought that the portion on the first line was there by mistake and moved it to the next line, attaching it to the rest of the word.

If you want to spiffy up your newsletter, I suggest that you get either Lazy Writer or NEWSCRIPT, both of which support proportional spacing. Proportional spacing adds the extra blanks needed to justify the line evenly between the letters instead of just between the words. This works because the increment is one dot wide (about 1/60th of an inch) instead of an entire space (about eight dots). If you have an Epson printer, a program called Maxprint produces the same justified proportional effect.

I need a driver program for the Epson MX-80FT printer with Graftrax, to be used with the new TRS-80 Model III Business Graphics Analysis Pak. The driver furnished by Radio Shack supports the V, VI, VIII, DWII, and multipen plotter/printers. Each of the four program disks must be modified with the driver program for the printer used. I tried all the drivers unsuccessfully. Fort Worth indicated that there wouldn't be any new driver programs in the near future.

None of the printers, except the plotter, are still being sold. Apparently all the newer printers have a switch that lets them emulate an LP VIII. I considered buying either the DMP-100 or the FP-215 Plotter/Printer, but was told that neither would be supported by a driver. The Epson is such a fine printer. I'd hate to buy another printer just for graphs.

J.P.
Bellevue, WA

I'm afraid I can't think of any solutions to your problem, so I'll throw this one out to the readers. Can anyone help J.P.?

I have a problem which is more annoying than a hindrance. When using either SuperScripsit or Scripsit, each performs an automatic form feed at the end of the printed text. This spews paper all over the floor. Can you provide a location and substitute code to replace the form feed to civilize these beasts?

J.H.H.
Scottsdale, AZ

80 Micro is coming out with a book of Scripsit patches and modifications that might be able to help you, but I don't know the release date. In the meantime, does anyone know of a way to defeat Scripsit's and SuperScripsit's automatic form feed at the end of the text printing?

I want to interface my Adler SE1010 electronic typewriter with my Model I and use it as a letter-quality printer with my SuperScripsit program. Desks Inc., who sells Super Cord (which interfaces the Adler 1010 through the serial port), says that the typewriter works fine as a printer when the serial option on SuperScripsit is chosen. Radio Shack advises that I'll have to write my own printer driver. Who's right? If Radio Shack's correct, where can I get a driver for my Adler SE1010?

Also, I keep being told that I don't have to limit myself to 48K; I can upgrade to 64K. Can my Model I be upgraded safely to 64K, and if so, what's the best way?

J.H.M.
San Clemente, CA

I think Desks Inc. has SuperScripsit confused with Scripsit. When you choose the serial option, Scripsit just ships the file out the RS-232 port. SuperScripsit, on the other hand, uses complex printer drivers that instruct it in sending the file to the printer. These drivers allow you to use your printer's special features, such as proportional spacing and different print fonts and pitches. Because Desks Inc. didn't tell you which SuperScripsit printer driver to use with their Super Cord, I suspect they don't realize the difference between the two word-processing programs. Call them back and ask them which printer driver you should use. If you need a custom driver, I don't know of any available for the Adler SE1010. Perhaps a reader can help.

As for the 64K memory question, I'll be discussing that next month. Also, *80 Micro* is doing an article on CP/M and 64K conversions for the Model I and III computers that will appear in the near future.

A computer magazine recently published a benchmark test for microcomputers based on the sieve of Eratosthenes. The best published time for a 4-MHz Z80 was 6.8 seconds. My Color Computer did the job in 2.5 seconds. To get this result I had to use Assembly language and shift into hyperspeed with an STA $FFD9. My question is this: Can I harm my computer by operating at 1.89 MHz?

D.M.
San Francisco, CA

If you don't take precautions, yes! The Color Computer was designed to operate at a specific frequency. Forcing it to operate at a higher speed pushes the components to their limits. Because they're working faster, they get hotter. If they get too hot, the computer malfunctions. If you do this too frequently, the components begin to break down

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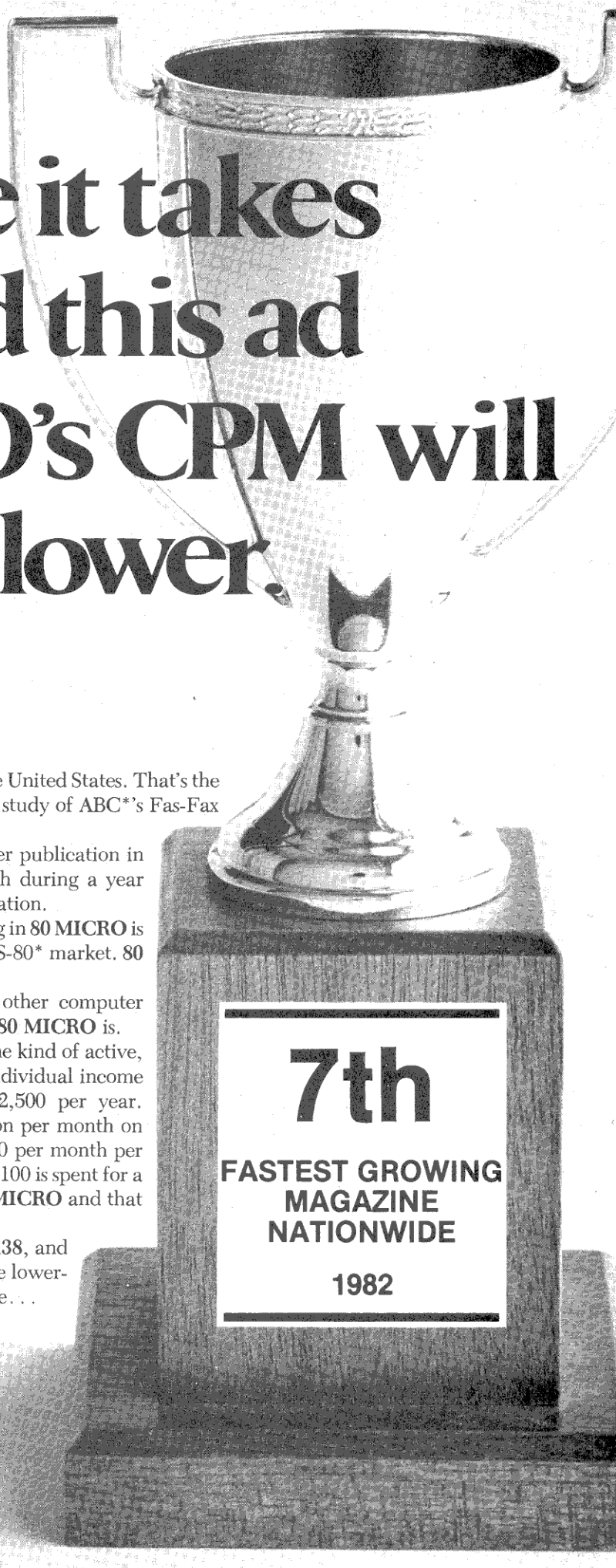

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(overheating is destructive to ICs).

To combat the overheating, install heat sinks on the CPU, SAM, and PIA chips. To help dissipate heat, set up a fan to blow air through the computer's vents. REM Industries Inc. (9420 B Lurline Ave., Chatsworth, CA 91311, 213-341-3719) sells a unit specially molded to fit against the Color Computer and keep it cool. The CoCo Cooler (Cat. No. AM501) retails for $39.95.

I have a copy of AIDS-III that I've used successfully on my system for a year now. My system is an old 48K dual-drive Model I with Aerocomp's DDC board installed. I usually operate under DOSPLUS 3.4D. The system works fine with either single or double density, but I have an annoying problem. The instructions for AIDS-III call for a shift/down-arrow combination for several functions. This doesn't work on my machine. I wrote the manufacturer and they said to use the shift/down-arrow/Z-key combination. That didn't work either. Is there a fix so I can use the shift/down-arrow combination?

M.B.
Winterport, ME

The problem has one of two sources: the ROM or DOSPLUS. The original Level II ROM had a flaw. The shift/down-arrow combination of keys is supposed to act as a control key. When these keys are pressed, the ROM is supposed to wait for the next key to be pressed and take its value as a number from 1 to 26 (A = 1, Z = 26) instead of its ASCII value (A = 65). Earlier ROMs (that power up Memory Size?) didn't wait, however. Instead, they used the value 26. In the newer ROMs (that power up Mem Size?) this bug was fixed and the ROMs wait for the next keystroke.

Unfortunately, software written for the older ROMs is designed to ignore the value 26 as the control key value and to wait for the next key pressed to get the right value. When this software is used on the newer ROMs, it doesn't work unless you press all three keys (shift, down-arrow, and Z) as the control key. To test your machine, use this program: 10 A$ = INKEY$:IF A$ = " "THEN 10 ELSE PRINT ASC (A$):GOTO 10. Now press the shift/down-arrow keys. If you get a 26, then you have the buggy ROM. If you get nothing, press the A key and see if you get a 1. If you do, you have a new ROM.

Try this in both Level II Basic and in Disk Basic. It's possible that the keyboard driver used by DOSPLUS 3.4D isn't responding properly. If you can get the combination keys to work in Level II but not in Disk Basic, hold down the shift/up-arrow keys as DOSPLUS boots up. This disables the DOSPLUS I/O routines in favor of the ROM routines. The disadvantage to not using the DOSPLUS I/O routines is that the Spooler program and other DOSPLUS I/O utilities may not work properly with ROM routines.

I have a program that uses polynomial regression to fit a line between any number of points. The program is a Basic adaptation of a Fortran program. The problem is that the program runs perfectly on an Apple II but not on my TRS-80. On the Model III the program always bombs on the fourth order of the polynomial regression and produces errors on the third order.

In attempting to debug this, I ran benchmark data on both the Apple and the TRS-80, comparing variables each time there was an update of either the matrix or an important variable. The problem centers around minor discrepancies on the matrix values between the two computers. For example, at one point in the third order of the regression, one matrix value of the Apple is 844,999,995 while the TRS-80 had 845,002,000. Though the difference is only .0024 percent, it's enough to cause problems with the TRS-80 program.

There are no errors in the program. The TRS-80 uses double-precision routines throughout the program. Whenever there's a function that can only be computed in single precision, it's converted to double precision by using the VAL(STR$) convention.

Can I do anything about this problem? I know the nature of polynomial regression is such that even a small error within the matrix is compounded over and over, but why isn't this happening on the Apple? By noting the values printed, I've concluded that the Apple is apparently using double precision.

M.C.
Rochelle, IL

Your problem is rooted in the single-/double-precision conversion routine. The single-precision routines are accurate only for the first six decimal places of a number. Converting a double-precision number to a single-precision throws away the last 10 decimal places of the double-precision number. By continuing to use the double-precision numbers elsewhere in the program, you're falsely assuming that the entire set of 16 digits is accurate.

There are two solutions to this problem. The first is a set of double-precision routines sold as a package by Radio Shack (#26-1704, $9.95). It gives 15-digit accuracy with the sine, cosine, arctangent, natural logarithm, exponential, and square-root functions. Unfortunately, this package is very difficult to obtain because it was discontinued a year or so ago. You might, however, be able to get a store to call the regional manager and do a search of all stores in the region to see if there are any copies left. A further disadvantage to the package is that it was designed to operate only on a 16K Model I or Model III.

Your only other choice is to write your own routines in Basic, avoiding the single-precision ROM routines. I had to do that once with a standard deviation equation. The program ran much slower because my calculations used a Basic equation to determine square roots, but it did give me 15-digit accuracy (the 16th digit is almost always worthless). The Apple has 12-digit accuracy and doesn't need to use conversion routines, so you don't have problems due to number-conversion errors.

I have a Model III with two TM100-4 disk drives with 80 tracks each. I have TRSDOS 1.3 on a 40-track disk. My drives came with an abbreviated TRSDOS 1.2. I have DOSPLUS 3.4 so I can read 40-track disks on my 80-track drives. How do I get TRSDOS 1.3 on an 80-track disk so I can use SuperScripsit and Profile III? I thought of Convert, but it states, "The actual Model III TRSDOS system programs don't appear in the directory so they won't be copied."

W.K.
Kent, WA

It isn't worth transferring TRSDOS 1.3 to solve your problem. If you did transfer it to an 80-track disk, it wouldn't work. TRSDOS 1.3 was written for a 40-track system. Putting it on an 80-track drive doesn't change a thing. TRSDOS would just treat the drive as a 40-track drive. Because the 80-track drive uses two tracks for every one in a 40-track drive, anything you did with TRSDOS on the 80-track drive wouldn't be readable by any other machine. In addition, putting TRSDOS on an 80-track disk would fail the first time you tried to boot up. TRSDOS expects to find the directory on track 20, but DOSPLUS puts the directory of an 80-track disk on track 40! Hence, TRSDOS wouldn't be able to find the directory during boot-up.

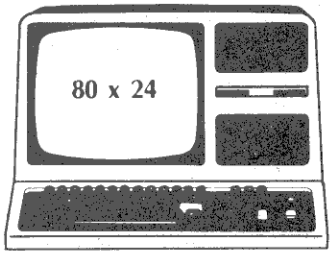
If you were a machine-language programmer, you could fix TRSDOS to operate in an 80-track environment, but it would take an awful lot of work. Why don't you put SuperScripsit and Profile III on DOSPLUS? All you need is a Superzap program to remove the protection of the two programs from the TRSDOS disk directory. Check with the DOSPLUS people and see if they can help you. ■

UPDATE

Several months ago I received a letter asking for help in finding a word processor for the visually handicapped. Well, I now have some great news! Ron Hutchinson has developed software for the TRS-80 Models II, 12, 16, and Lobo computers that interlock with the operating systems and allows any program to become speech-oriented. Pressing a control key makes the computer send the video screen data to the RS-232 port.

With the use of the Votrax speech unit, you can have words spoken and punctuation spelled, or everything spelled. Many other features are included. Model I/III versions are currently being developed. For more information contact Ron Hutchinson, SofTalk Systems, 2350 N. Fourth, Columbus, OH 43202, 614-263-4324.

Terry Kepner is a freelance writer and programmer, and the vice president of Interpro. He's been writing about microcomputers since 1979.



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by Amee Eisenberg

Fleas and powder

"Your program doesn't run," a man anxiously intoned when I answered the phone. "How do I fix it?"

Load 80 problems fall into two categories: fleas (simple mix-ups created in the Load 80 production process) and bugs (major program problems). By the time a program finishes the *80 Micro* technical review, the only bugs left are anomalies.

The fleas, however, seem to bite every new program. In Basic programs, they show up as syntax and undefined line errors. The good news is that they are easy to fix.

A "Syntax Error in line XX" message appears when Basic's grammar is distorted. If you list the offending line, some obvious syntax error appears. The most common problems are incomplete sets of quotation marks or parentheses, Ifs without Thens, Fors without Nexts, semi-colons where there should be colons, or mistyped characters.

Examine the offending line carefully. Think like a computer—take every character literally. Compare the line with that printed in *80 Micro*. Then correct the error, using Basic's Edit mode (on a back-up copy of Load 80, of course). Save the program with its corrections.

An "Undefined Line Number in XX" message means a program line is missing. When you list the line mentioned in the error message, it invariably refers to another line. This is the line that's missing or "undefined." When you list the undefined line, the computer displays nothing but the Ready prompt (see Fig. 1).

Solve this by replacing the missing line. Read the program listing in *80 Micro* to find the correct line. Enter it, typing carefully to avoid creating syntax errors. Save the corrected program.

Sometimes an undefined line error becomes positively mysterious. The mystery usually involves a block of lines. When you list the entire program, the undefined lines scroll across the screen. And yet, when you list those specific lines, the computer insists that it can't find them.

This suspicious behavior is due to a line that's out of sequence. If line 90 gets between lines 20 and 30, the computer cannot read lines 30–89. The program lists completely, because when listing, the computer spits out what's in immediate memory.

But when it runs, the computer reads those lines in numerical order. If it hits line 90, it knows that it has already seen every line before line 90. In the example, this means that lines 30–40 become "undefined."

Two steps are required to fix this: First, locate the out-of-sequence line and then correct it. Track down the last visible, or defined, line by listing short blocks of program lines. Referring to the example above, LIST 10–20 works fine. LIST 10–30 shows lines 10 and 20 but not line 30. LIST 30–40 shows nothing but a Ready prompt. That's the clue to where the bad line sits (see Fig. 2).

Now list the entire program and use shift/control (or the space bar in DOSPLUS) to pause the display near the suspect line. Read the display carefully.

Once you locate the out-of-sequence line, you must correct it. Check the program listing in *80 Micro*. Delete the out-of-sequence line, retype it, and press enter to let the computer insert it in the appropriate place. Finally, save the corrected program.

These simple procedures get most Load 80 Basic programs running in no time. In the future, we'll take up some other common error corrections. ■

Neither Pascal nor Fortran are available for TRS-80 tape-based systems. Therefore, the programs CRIB/PAS, BREAKOUT/FOR, and USRLIB/MAC are not on this tape. If you are a tape Load 80 subscriber who has disk drives for your system and would like a machine-readable copy of these programs, please send us a disk and we will copy them for you.—Eds.

```
10    PRINT "I LOVE YOU"
20    GOTO 5
RUN
Undefined Line number in 20
  20 GOTO 5
READY

5     PRINT "BABY, IT'S TRUE"
RUN
BABY, IT'S TRUE
I LOVE YOU
BABY, IT'S TRUE
I LOVE YOU

BREAK IN 20

READY
```

Fig. 1. Out of Sequence Line

```
10    INPUT "IS 2+2=4?";A$
20    IF A$="Y"GOTO40
90    PRINT "YOU'RE SMART"
30    PRINT "YOU'RE DUMB"
35    END
40    PRINT "THAT'S RIGHT"

RUN

Undefined line number in 20
  20   IF A$="Y"GOTO 40
READY

LIST 10-30
10    INPUT "IS 2+2=4";A$
20    IF A$="Y"GOTO 40
READY
```

Fig. 2. Undefined Line Number

Index	Page	Article	File Spec	Comments
Side 1				
A			COPYRGHT/BAS	Tape Only
B	130	Which Way the Wind Blows	WEATHER/BAS	None
C	94	A Pascal Primer	CRIB/PAS	Pascal†
Side 2				
D	290	Profile File Transfer	XFER/PRO	Needs Profile
E	186	Fortran Breakout	BREAKOUT/FOR	Fortran†
FEA	186	Fortran Breakout	USRLIB/MAC	Needs EDTASM*†
GEA	24	The Next Step	NXTSTEP1/SRC	Needs Ed/Asm
H	24	The Next Step	NXTSTEP9/BAS	None

Note: Programs indexed with a letter followed by EA need an editor/assembler (Ed/Asm).

* EDTASM is a Radio Shack product. † Not included on cassette.

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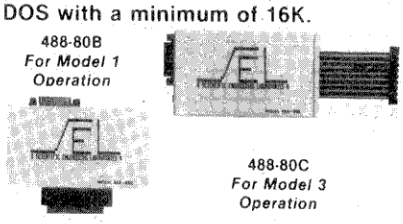

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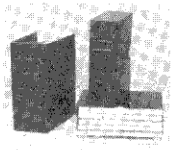

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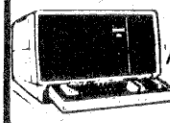

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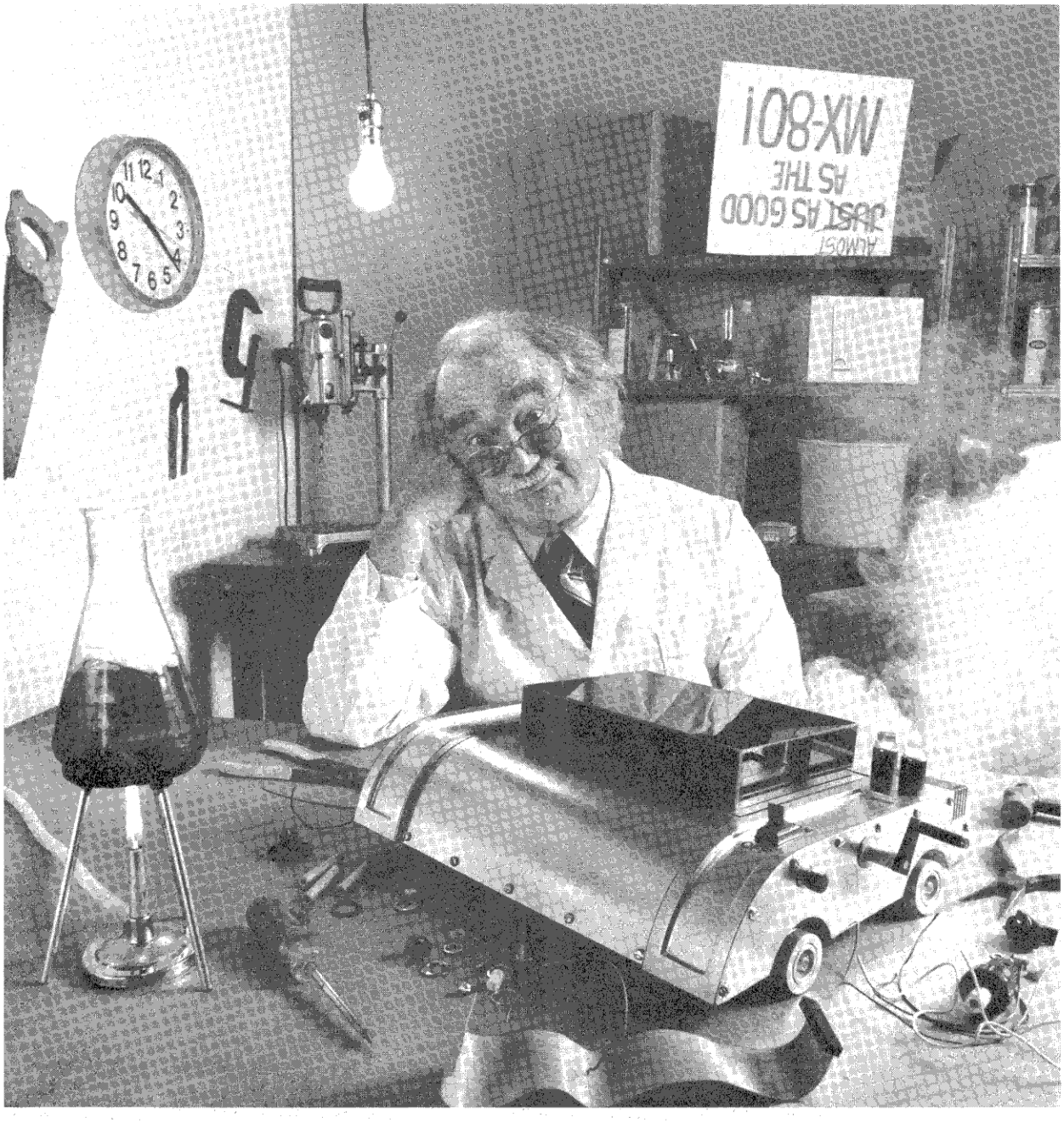

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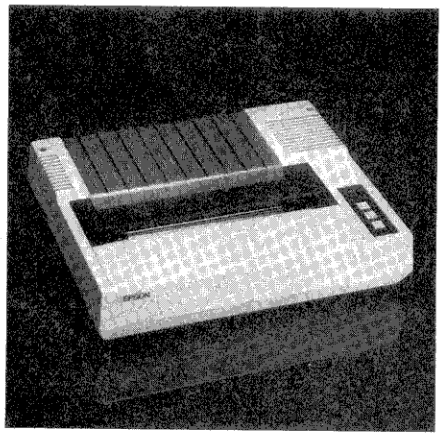

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edited by Eric Grevstad

Australian Editing Aid

Supa*Edit is a machine-language program that enhances Level II Basic's List and Edit commands. It is suitable for both Model I and III tape-based systems (16K and above), and includes a lowercase driver for the Model I.

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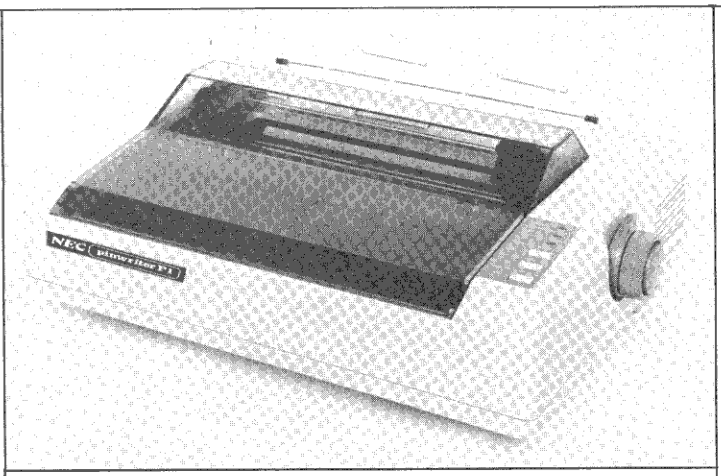


NEC Pinwriter Printer

NEC Goes Dot-Matrix

NEC Information Systems, maker of the Spinwriter daisy-wheel printers, has introduced the Pinwriter family of 18-pin dot-matrix printers.

The 80-column Pinwriter P1 and P2 ($799 each) feature a Centronics-type and optional RS-232 interface respectively. Both offer 90-cps high-density and 180-cps speed printing; the P2 adds a program- or user-selectable dual-pass mode for near letter quality output at 35 cps. The P3 ($1,250) has the same three modes as the P2, with a print line length of up to 231 instead of 136 characters.

All three Pinwriters support 10-pitch pica, 12-pitch elite, and 17-pitch condensed printing, as well as proportional spacing, boldface, and underlining. The P2 and P3 allow system download of custom character sets. Vertical line spacing can be set for three, four, six, or eight lines per inch on all models.

The printers are sold by NEC Information Systems Inc., 5 Militia Drive, Lexington, MA 02173, 617-862-3120.

Reader Service ✓581

Model III Service

Sorbus, an independent company that offers nationwide service for IBM, Apple, and other computers, now maintains the Model III and its peripherals.

The firm offers on-site, van pick-up, or carry- or ship-in repair through a network of 160 service locations, 15 maintenance depots, and eight Sorbus Station retail centers. The stations provide 24-hour turnaround for Radio Shack or other vendors' Model III-compatible equipment.

Defective units are shipped for servicing with or without a prior maintenance agreement. Agreement and other information is available from Sorbus Service Division, Management Assistance Inc., 50 E. Swedesford Road, Frazer, PA 19355, 215-296-6000.

Reader Service ✓562

1.6 MB Minifloppy

Inflo Inc.'s new line of super-dense half-height disk drives promises a capacity of 1.6 megabytes (unformatted) on a 5¼-inch floppy, accomplished by emulating an 8-inch double-sided drive. Four drives fit in the space of two conventional ones for a total memory capacity of 6.4 megabytes.

In addition to the super-density option, the drive supports the standard 8-inch IBM 3740 (single-sided, single density) format.

For more information, contact Inflo Inc., 244 Mill Road, Yaphank, NY 11980, 516-924-9229.

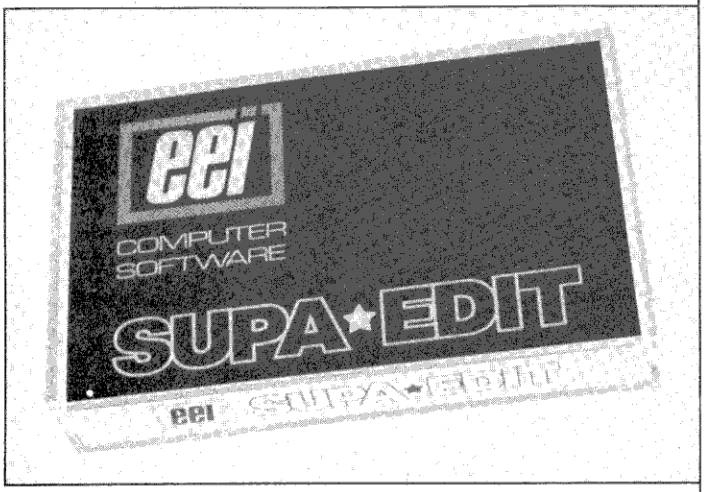
Reader Service ✓574

Counting Every Cent

Hexis (Home Expense and Inventory System), a menu-driven software package for the two-disk, 48K Model III, lets users define up to 64 income or expense accounts. Daily account totals are stored on disk, along with a detailed statement of all entries and net total for each session.

The program provides for six reports, from a monthly profit/loss statement and annual survey to special reports on specific accounts or time periods. A 132-column printer is required.

Hexis carries a 30-day money-back guarantee and a 12-month warranty. Its intro-

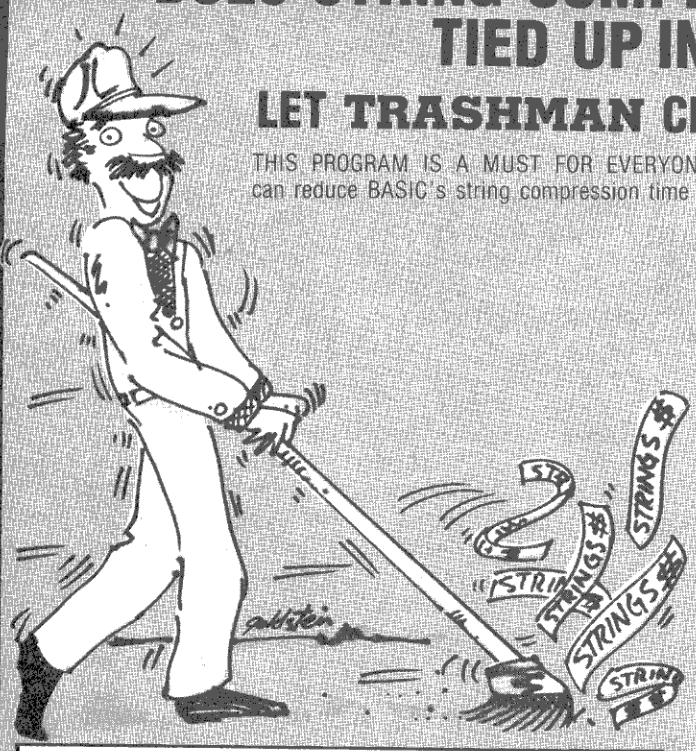


Level II Editor

DOES STRING COMPRESSION HAVE YOU TIED UP IN KNOTS?

LET TRASHMAN CLEAN UP THE MESS!

THIS PROGRAM IS A MUST FOR EVERYONE WHO USES "BASIC" ON A TRS-80. Why? Because it can reduce BASIC's string compression time delays by 95% or more.



WHAT'S STRING COMPRESSION?

When a BASIC program changes a string (words, names, descriptions), it moves it to a new place in memory, and leaves a hole in the old place. Eventually, all available memory gets used up and BASIC has to push the strings together to free up some space. This takes time. Lots of time. The computer stops running for seconds or minutes, and you may even think it's "crashed".

Yes! String compression is what's been causing all those intolerable delays. The keyboard won't work, and until all the strings have been collected, you just have to sit and wait. Then things run for a while, until string compression is needed again. And again.

If you're using your computer for business, that wastes your money. If you're using it personally, it wastes your time.

WHAT'S THE SOLUTION?

As soon as you start using TRASHMAN, those delays will almost disappear. The program is **very easy to use**, so you don't have to be a computer programmer to take advantage of it. It's written in "machine language" and uses only 578 bytes of memory for itself, plus two bytes for each "string" in your program. It works with other machine language programs and all the major operating systems.

HOW WELL DOES IT WORK?

If you use it with a BASIC program that has only a few strings, very little time is wasted in string compression, and TRASHMAN will be only slightly helpful. But, in programs that use hundreds or thousands of strings, including large string arrays, TRASHMAN is just what you need. If you have any remaining doubts, just look at the chart, and then get yourself a copy as fast as possible.

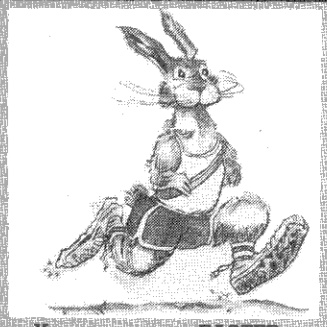
# STRINGS	SECONDS DELAY NORMAL	SECONDS DELAY TRASHMAN	PERCENT IMPROVEMENT
250	11.8	0.7	94
500	45.8	1.6	96.5
1000	179.6	3.5	98
2000	713.2	7.8	98.9

(All timings done on TRS Model I. Model III 15% faster, but pct improvements identical. Listing of timing program available on request.)

TRASHMAN is available on disk for just $39.95.

ATTENTION SOFTWARE PUBLISHERS:
Trashman may be licensed for use with your packages. Call for details.

SAVE TIME WITH FASTER



"FASTER" speeds up most TRS-80 BASIC programs by 20-50%. It's helped hundreds of satisfied people and it can help you. Detailed instructions make it easy to use. FASTER analyses your BASIC programs *while they run*, then displays a simple change, usually one line, that sequences program variables so the ROM will find them faster.

You can use FASTER to speed up programs you've bought, as well as programs of your own. Since it isn't a compiler, your BASIC programs can be read and changed afterwards. FASTER works on business programs, models, and games. The more complex your program, the better the results.

Does FASTER really work? Yes! Just check the reviews in *Personal Computing*, May, 1981, p. 116: **"FASTER is effective and easy to use"**; *80 U.S. Journal*, April, 1982, p. 106: **"I recommend FASTER to everyone"**; and *80 MICRO* (April, 1982, p. 40): **"If you...would like a significant increase in the run-time speed, then buy FASTER."**

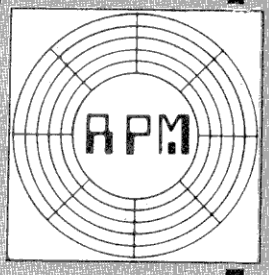
FASTER runs on the TRS-80 Models I and III, 16-48K tape or disk, and all major operating systems. **$29.95**

"QUICK COMPRESS" takes only 276 bytes of memory, and removes the blanks and remarks from even the largest BASIC program in less than 3 seconds. It produces smaller, faster programs without altering their logic.

$19.95

SPECIAL: FASTER and QUICK COMPRESS: **$39.95**

ERRATIC DISK DRIVES?



You can avoid unnecessary disk errors and repair bills by using **RPM.** This easy-to-use program measures the rotational speed and fluctuations of your disk drives, and warns you if they are running **too fast, too slow, or unevenly.**

Incorrect or erratic speed is a common cause of unexplained disk errors and loss of data. RPM's documentation explains how to **detect** *and* **correct** these problems quickly and easily. As *80 MICRO* (April, 1982, page 41) said: **"If your drives have problems I recommend RPM before paying to get it repaired."**

RPM is supplied on diskette for the TRS-80 Models I and III. We suggest you order *a copy before* you need it.

$24.95

ORDER FROM YOUR LOCAL SOFTWARE DEALER, OR CALL NOW, TOLL-FREE:
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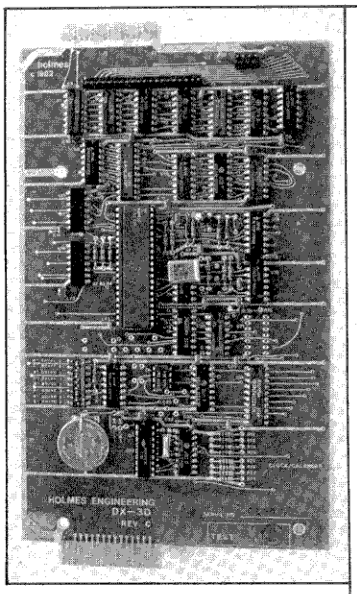


Holmes DX-3DC

ductory price is $49.95; list price will be $99.95 after September 1, 1983. It is available from International Software Brokers, P.O. Box 628, Proctor, VT 05765, 802-459-2088.

Reader Service ✓572

New I/III Language

Pajaro (pronounced Pa-ha-ro) is a new software system for 48K Models I/III. It requires one disk drive, works with most DOSes, and includes a full screen editor and user library.

Pajaro is a high-level language, similar in syntax to Basic, with a number of extensions such as user-defined commands and statements. A Do command lets users load a precompiled program with local variables, then return to the original program or Do another while the main program is still in memory.

Sound, Draw, and 2-byte PEEK and POKE commands are included, and both random and sequential files are supported. The math package features integer and 32-place floating point variables.

The package is meant to reduce the time spent in software development. Users can call their own specialized routines at any time; once a program is compiled by Pajaro's Mule (Multi-User Language Encoding) system, it requires few changes for compatibility with other computers (IBM PC and Apple II units are planned for early 1984).

With manual included, the system costs $89.95 from RDS Software, 79 Hill Ave., Watsonville, CA 95076, 408-722-5354.

Reader Service ✓577

Model III Disk Controller

Holmes Engineering offers two fully assembled and tested floppy disk controller boards for the Model III. The boards can be configured to allow the use of any combination of 5¼- and 8-inch drives.

The DX-3D ($189) uses gold edge connectors, fully buffered address and data lines, and an advanced digital phase-locked loop circuit. The DX-3DC ($229.50) adds a user-programmable real-time clock and calendar, powered by an onboard lithium battery for reliable time even when the computer is turned off or unplugged.

The boards are available from Holmes Engineering Inc., 3555 South 3200 West, Salt Lake City, UT 84119, 801-967-2324.

Reader Service ✓583

The Talking II/12/16

Compu-Talk is an Assembly-language program that modifies the 64K Model II, 12, or 16 to become a talking computer, word processor, or dumb or intelligent terminal. The program merges with TRSDOS 2.0a, allowing users to completely control the voice synthesizer. It needs no disk space for a vocabulary.

Using single-keystroke operation, Compu-Talk gives spelled speech, total speech, upper- and lowercase identification, line and column number, and reading or spelling of the current line or entire screen. It currently works with Basic, Scripsit 1.0, and many other Radio Shack programs, including Tandy's Bi-Sync package.

The program costs $129.95. It requires the Votrax Type 'N' Talk (with speaker/amplifier) or Personal Speech System synthesizer, available for an additional $250 or $400 respectively, and an RS-232 cable ($30).

For more information, contact SofTalkSystems, c/o JC, P.O. Box 28355, Columbus, OH 43228, or call 614-279-8271 after 6:30 p.m. EDT.

Reader Service ✓568

Portable Power Protection

The Stedi-Watt Jr. "Computer Pal" gives complete three-stage protection against powerline spikes and transients in a unit that plugs into any grounded duplex outlet. It stops surges within 10 nanoseconds.

Its price is $59.50 from National Field Sales Inc., P.O. Box 230, Broomall, PA 19008, 800-345-1280.

Reader Service ✓555

Business Computer Network

The Business Computer Network is offering a free telecommunications disk to those subscribing before July 1, 1983. The program, valued at $49.95, automatically dials and logs onto one of hundreds of data bases and on-line services chosen from a central menu. Only a single keystroke is required.

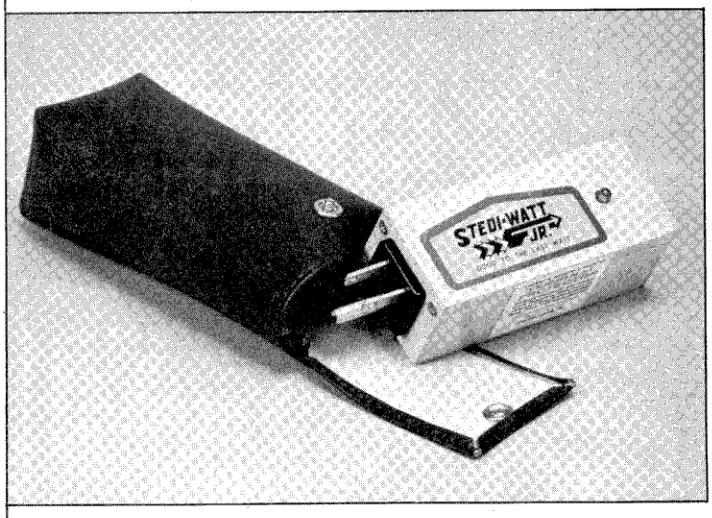
Besides data-base access to such items as news, games, and stock and commodity prices, the Network offers electronic mail, a weekly on-line newsletter, system utilities, and object-code downloading of software. There are no sign-up fees; members pay on-line service charges and a monthly utility fee.

For more information, contact the Business Computer Network, 211 S. Fourth St., Basin, WY 82410, 307-568-2413.

Reader Service ✓567

CoCo Math Programs

Mathmenu is a collection of 15 math/engineering programs for the Color Computer with Extended Basic. Two plotting programs display 3-D surfaces and X, Y functions on the high-resolution



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Requires: TRS-80* Model I only
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Tape #0140R $75.00
Disk #0152RD $99.95

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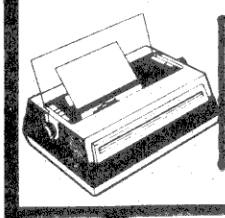

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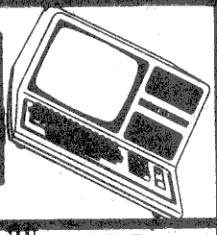

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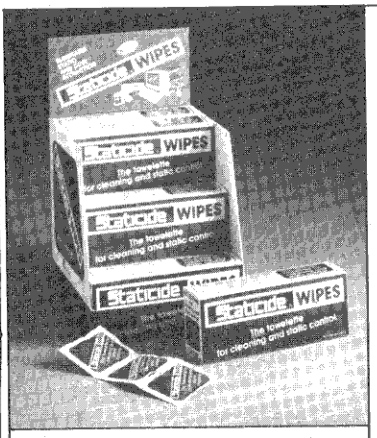


Staticide Towelettes

(PMODE4) graphics screen; two additional programs offer collections of matrix and vector operations.

Other programs include numerical differentiation and integration, base conversions, reverse Polish logic, binomial expansion, rectangular/polar conversions, and quadratic equation roots. Each program displays informational text; a documentation booklet adds detail.

The 16K Mathmenu cassette costs $44.95, and a menu-driven 32K disk costs $49.95. Both are available from Inter + Action, 113 Ward St., New Haven, CT 06519.

Reader Service ✓561

Anti-Static Towelettes

According to ACL Inc., static charges cause as many as 60 percent of all service calls on computer and other electronic equipment. Staticide Wipes are 5½-by-8-inch towelettes that fight static buildup and dust attraction without the inconvenience of bottled CRT cleaning fluids.

A box of 24 wipes in 2-inch foil envelopes sells for under $5 from ACL Inc., 1960 E. Devon Ave., Elk Grove Village, IL 60007, 312-981-9212.

Reader Service ✓556

Build Your Own DBMS

DBM Sub is a disk of Model I/III Basic routines that let you create a data-base management system customized to your exact needs. Features available for DBMS architects include 50 different screen formats, up to 70 files per data disk, and data bases within data bases. In some cases, says the manufacturer, your system will be faster than commercial machine-language programs.

The DBM Sub disk contains printer, format, disk I/O, and other routines, and works under most DOSes. With full instructions on DBMS design and construction, it sells for $49.95 from K & L Software, P.O. Box 39093, Northbridge Station, Charleston, SC 29407, 803-552-9990.

Reader Service ✓584

New Diablo Printers

Diablo Systems Inc., known for its Model 620 and 630 daisy-wheel printers, has added correspondence-quality models to its line of dot-matrix units. In addition, a $1,250 color ink-jet printer is scheduled for release in the third quarter of this year.

The 11A and 31A printers use a 16-by-35-dot matrix to create near letter-quality output at 100 cps. They feature 2K print buffers and front-feed of cut sheets.

Diablo's four standard dot-matrix machines promise a 4,500-hour mean time between failures. The 9-by-7-dot matrix, 100-cps Series 11 ($649) and 31 ($950) print 80 and 132 columns respectively. The Series 32 receive-only teleprinter ($1,394 to $1,495) offers 150 cps at 300, 1,200, 2,400, or 9,600 baud, as well as graphics with up to 5,000 dots per square inch. The Series 38 ($2,195) uses a bidirectional, logic-seeking print head with a 7-by-7-dot matrix for speeds up to 400 cps.

The Series C parallel ink-jet printer operates at 20 cps, using a 120-dots-per-inch

nozzle that places a dot of ink virtually anywhere on the page. It prints in seven colors, is switch-selectable for uni- or bidirectional printing, and generates color backdrops, halftones, and combined text and graphics. Its ink dries in one second on standard paper.

The printers, as well as the enhanced Model 620 Plus daisy-wheel ($2,100), are available from Diablo Systems Inc., 24500 Industrial Blvd., Hayward, CA 94545, 415-786-5000.

Reader Service ✓579

Cassette Port Expander

The Tixim Model CC lets you control up to four cassette recorders through a 16K Color Computer's cassette port. It is supplied with power transformer module, cord, and one port connection cable, and requires no hardware modification.

Utilities supplied on the Tixim cassette copy, verify, and display or print contents of tapes in recognizable formats. Another utility allows operation of the unit through Extended Basic statements controlled via USR calls; sample programs demonstrate a four-recorder data merge and generate and recover 254-byte data strings.

The expander sells for $139.95 from Starflower Technology Inc., 1031 E. Duane Ave., Suite H, Sunnyvale, CA 94086.

Reader Service ✓582

Things to Do Today

Priority Organizer is an inexpensive program for the Models II/12/16 that lets managers or individuals organize and keep track of tasks.

Each employee's assignments, jobs, or projects are stored on disk. Jobs can be added, deleted, corrected, or marked as finished; the program automatically sorts and prints items by high, medium, and low priority.

The Organizer stores up to 100 items on a 64K computer. It sells for $29.95 on disk from Data Automation Services Inc., 4 E. Germantown Pike, Plymouth Meeting, PA 19462, 215-825-3435.

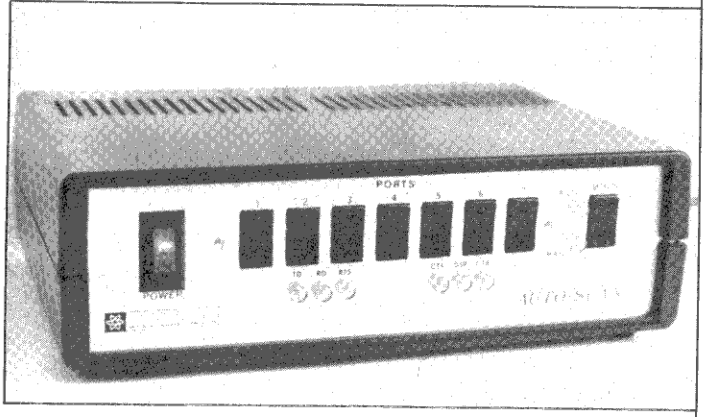
Reader Service ✓558

Share a Peripheral

The Giltronix ASN is a switching unit that allows several CPUs to share a printer, modem, or other RS-232 device. The unit automatically scans for keyboard or program signals from a CPU requesting access to the shared device.

As long as one port's CPU is using the device, other inquiries are answered "Scan busy"; when the connection is broken, the ASN immedi-

Continues on p. 382



Giltronix ASN

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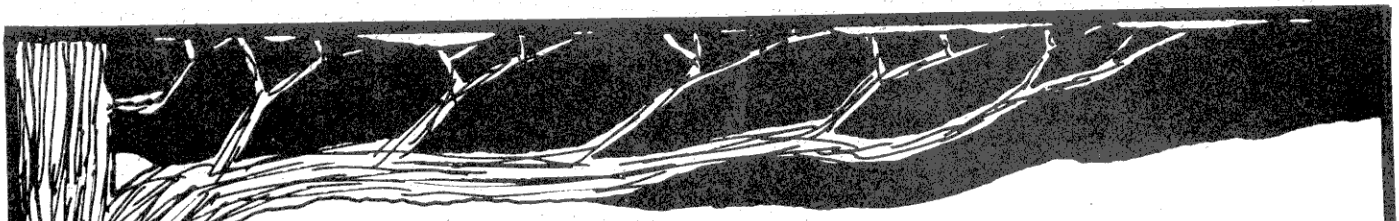

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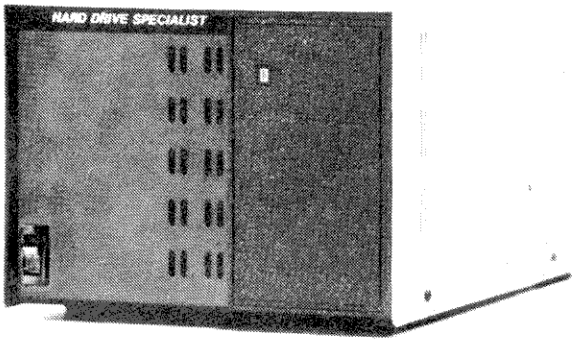

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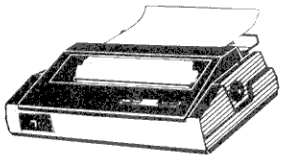
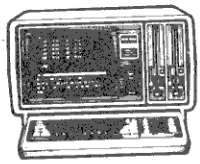
↙ See List of Advertisers on Page 355

RadioShack TRS-80's
Full Line





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NEW PRODUCTS

Continued from p. 379

ately resumes its scan. Front panel switches provide manual control.

The unit is available with three, five, or seven ports (priced at $249, $349, and $449 respectively). It is compatible with Giltronix's ASU, which lets one computer choose from among several peripherals.

To order, contact Giltronix Inc., 970 San Antonio Ave., Palo Alto, CA 94303, 415-493-1300.

Reader Service ✓578

Fanfold Forms and Stationery

A new mail-order company, Micro Format, offers continuous computer forms in small quantities for home or business users. Available items include "clean edge" perforated letterhead, index cards, postcards, envelopes, labels, and checks.

A $24 starter kit includes 500 sheets of blank stationery, labels, and 3-by-5-inch index cards. The starter kit and product catalogs can be ordered from Micro Format, 1271 Dundee Road, Suite 16A, Buffalo Grove, IL 60090, 312-537-2426.

Reader Service ✓576

Vocabulary Practice

Quilt Letters is a package of three programs that use a 4- by 4-box grid of letters to improve junior and senior high school students' vocabularies.

In Quilt, players match wits with the computer in placing letters within the grid to create vertical, horizontal, and diagonal words. Grid is a solitaire version. A third game, Supersix, challenges students to create as many words as possible from a randomly generated word displayed in the grid's leftmost column.

The package requires a Model III with 48K and two disks. It sells for $69.95 from Joseph Nichols Publisher, P.O. Box 2394, Tulsa, OK 74101, 918-583-3390.

Reader Service ✓575

MX-80/CoCo Connector

Spectrum Projects' Epson interface plugs directly into a connector inside the MX-80 printer and terminates in a four-pin DIN plug that fits the Color Computer's serial port. It operates the MX-80 at the normal 600-baud rate, with settings up to 4,800 baud available through POKE commands.

The interface works with either Color 1.0 or 1.1 Basic ROM and accesses the Epson graphics set through software. Its price is $49.95 from Spectrum Projects, 93-15 86th Drive, Woodhaven, NY 11421, 212-441-2807.

Reader Service ✓552

III Terminal Software

The Model III Terminal program turns your TRS-80 into a dumb terminal, letting you access hobbyists' networks or business computers.

It supports full and half duplex and transmits all the printable ASCII characters not found on the Model III keyboard. Users can execute TRSDOS commands from within Terminal.

The program sells for $49.95 from Absecon Software Associates, 550 Fourth St., Absecon, NJ 08201, 609-646-9322.

Reader Service ✓563

Rekord

Rekord is a menu-driven program for the Model III that lets you create and modify financial or other data bases. It provides a specialized text editor and screen prompts for easy use.

The input format is flexible; the program checks to

see whether query responses are proper and allows easy entry correction or modification. Data is grouped in up to 20 categories or accounts, each with two subcategories or pages. Each account is allowed six lines of identification. A checkbook feature lets you add and subtract mathematical entries.

The machine-language program costs $49.95 from Lewsoft, P.O. Box 333, Los Alamos, NM 87544. Please specify cassette or disk and 32K or 48K Model III.

Reader Service ✓566

Keywiz VIP

The Keywiz VIP (Very Intelligent Peripheral) contains 31 function keys, each of which can be programmed with up to eight characters.

Keys can be programmed again using the shift key, giving 62 user-defined functions per keyboard. The device's memory stores four keyboards (an LED display shows which you're using), for a total of 248 programmable keys. Keys can be redesignated at any time, and the unit is independent of all software.

The Model III version is $439 from Creative Computers, Aztec Environmental Center, 1044 Lacey Road, Forked River, NJ 08731, 609-693-0002.

Reader Service ✓570

Color Chess

Chess-D, a 32K Color Computer program, is one of the fastest microprocessor chess programs available. It inspects up to 10,000 moves per second, looking at least five plays ahead at tournament level (1.5 minutes per move).

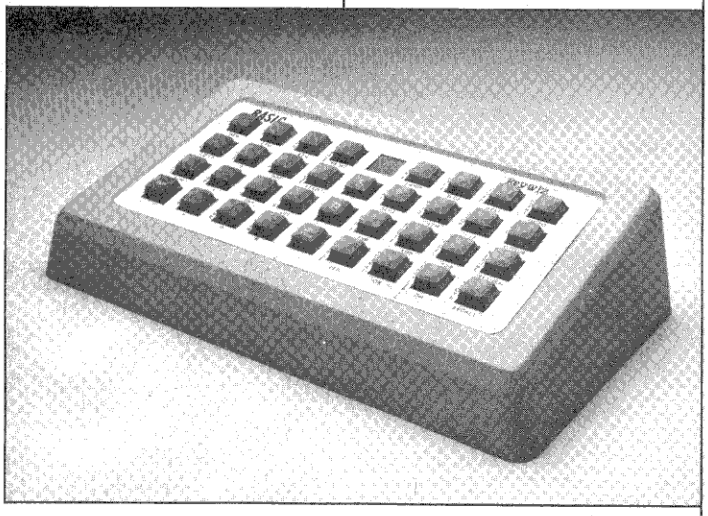
Players can set or change the look-ahead level from novice to expert at any time during a match. The program plays as either the black or white game pieces, recognizing and using all chess moves including en passant and promotion to any piece. High-resolution graphics display the board.

Chess-D is available for $39.95 (cassette) or $49.95 (disk) from Computer Systems Distributors, P.O. Box 9769, Anaheim, CA 92802, 714-772-1390.

Reader Service ✓550

Check Your Hunches

Dual Moving Average, first in the Market Master series of investment programs for the Models I/III, lets users test, refine, and improve stock or commodity



Keywiz VIP

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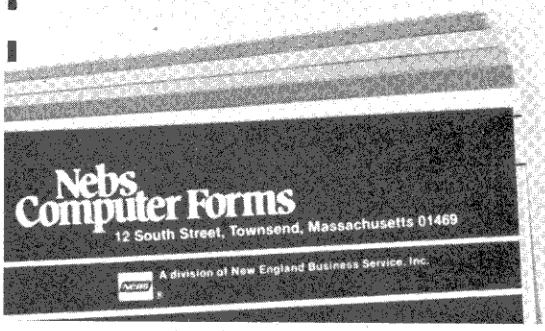


✓533

trading strategies without capital risk.

The program determines buy and sell points according to the intersection of two moving averages. Users can select the length of either average, or let the program find the most favorable lengths. Besides printing buy and sell recommendations for up to 100 stocks, the Market Master also produces graphs and reference sheets.

Its price is under $125. For more information, contact Management Services, 2901 Clendenen Lane, Longview, TX 75601, 214-753-1850.

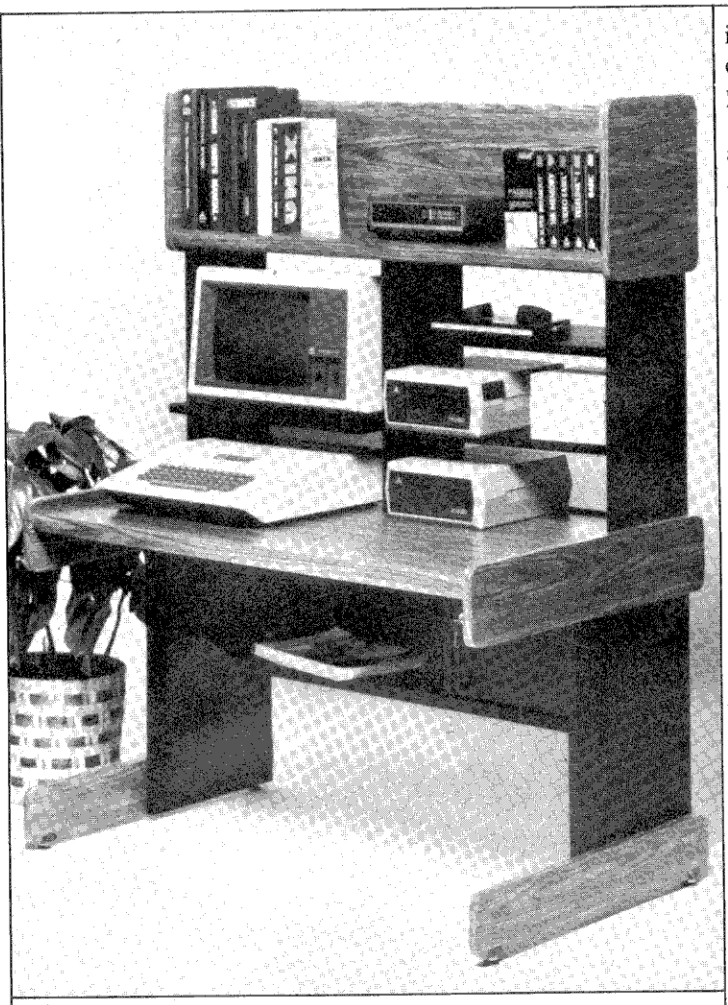
Reader Service ✓554

Modular Micro Furniture

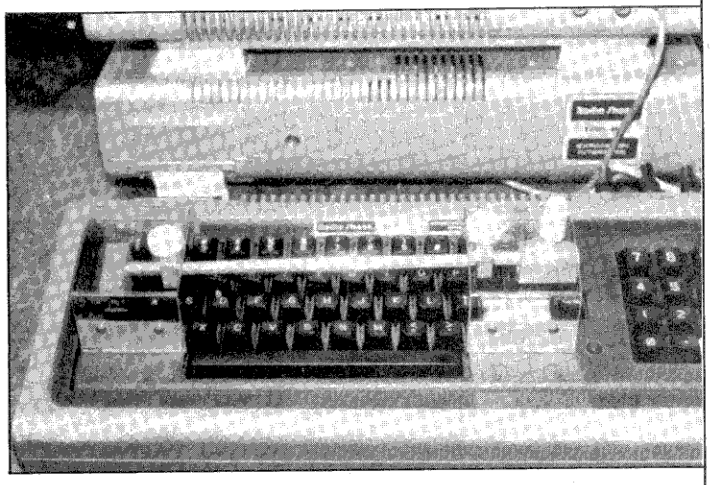
Bush Industries Inc. (312 Fair Oak St., Little Valley, NY 14755) offers a line of modular furniture for computer and peripheral storage and use. All items are finished in an Ashley Oak vinyl veneer with black matte vinyl accent panels and rounded edges.

The lineup includes a desk with 44-inch-wide work surface, recessed shelf, and lockable cabinet ($169.95), a desktop hutch with adjustable shelves ($99.95), a rollabout table ($79.95) suitable as either a beginner's desk or printer table (with rear opening for paper feed), and a video monitor platform ($17.95).

Reader Service ✓580



Bush Industries Desk and Hutch



Joy-80 and Model I

Mechanical Joystick

Advertised as "a joystick that won't void your warranty," the Joy-80 uses no electrical connections to give four-way control of Model I/III games.

The detachable unit clips to the keyboard. Two adjustable levers press the up, down, left, and right arrow keys as you move the joystick.

It costs $19.50 from Van Enterprises, P.O. Box 238, Oak Forest, IL 60452, 312-687-6053.

Reader Service ✓571

Many Modems

Universal Data Research Inc. has introduced a complete line of RS-232 modems designed around two LSI integrated circuits and crystal-controlled for high performance.

Three 300-baud modems—acoustic ($149), direct ($179), and auto-answer ($219)—provide half- and full-duplex operation. The direct- and auto-answer 1,200-baud units ($449 and $499 respectively) give full-duplex operation with switch-selectable local echo.

Two Bell 212A-compatible modems ($549 auto-answer, $599 auto-dial) transmit at either baud rate. A modem I/O board ($119) automatically selects the speed, adjusting to 300 baud after testing for 1,200.

The modems and I/O board are available from Universal Data Research Inc., 2457 Wehrle Drive, Buffalo, NY 14221, 716-631-3011.

Reader Service ✓564

Filmastr

Filmastr is a data management system for Color Computers with 16K Extended Basic. It offers custom screens with up to 20 user-definable fields, full-screen editing, formatted printouts, fast machine-language sorts, and a variety of relational search techniques to locate records or groups of records.

A screen window provides menu selections, instructions, and reports. File capacity is approximately 9,000 characters (24,000 characters in a 32K machine).

Its price is $29.95 (cassette) or $34.95 (disk) from The Computer House, Box 1051, Dubois, PA 15801, 814-371-4658.

Reader Service ✓553

Fun for II/12/16 Owners

Rizzo Data Systems Corp. offers a line of game software for the 64K Models II/12/16. All products are available on a TRSDOS 2.0 disk, and

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For the TRS-80 Models I, III (48K, 2 disk drives, lower case required). Available at your favorite software store or order from **Software Options,** 19 Rector Street, New York, NY 10006. (212) 785-8285. **Toll-free order line: (800) 221-1624.** Price $145 (plus $3 per order shipping and handling). New York State residents add sales tax. Visa/Mastercard accepted.

SOFTWARE OPTIONS INC™

✓537

✓ See List of Advertisers on Page 355

many on TRSDOS 1.3 or 4.1 disks as well. Some require a printer.

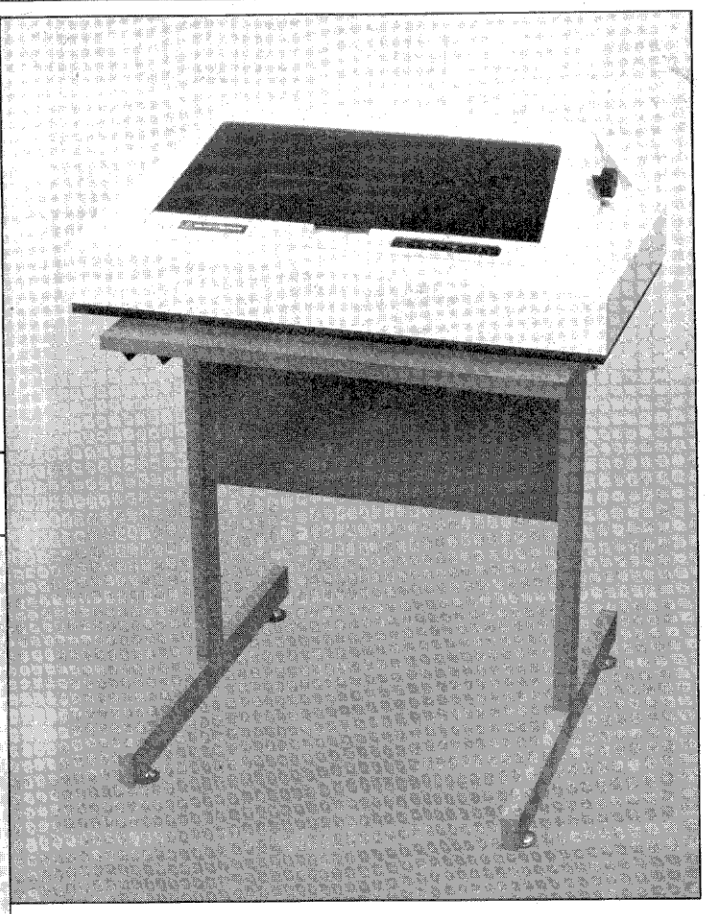
The programs range from Ricochet, Star Trek, and Biorhythms ($25 each) to two six-game packages ($70 and $75) and Scott Adams' Adventures 1–12 ($129.95). For those who insist on sticking to business, there's an amortization calculator ($25) and Deluxe Personal Finance ($79.95).

For more information, or to order (add $3 shipping and handling), contact Rizzo Data Systems Corp., 33 Westwood Ave., P.O. Box 458, Bridgeton, NJ 08302, 609-451-7964.

Reader Service ✓557

Improved Dot-Matrix Printer

The DP-9625A, an enhanced version of the Anadex printer introduced in 1982, provides four printing modes as well as graphics capability at 72 or 144 dots per horizontal or vertical inch.



Anadex DP-9625A

Single-pass printing options include 200-cps data processing and 150-cps correspondence-quality modes, and condensed printing modes of 15 and 16.4 characters per inch (150 and 164 cps respectively). A double-pass, near letter-quality mode operates at 60 cps at 12 cpi and 50–60 cps with proportional spacing.

The $1,995 printer also offers left, right, and full justification, title centering, positive half-line feed, in-line font changes, and RAM expandable to 12.5K. Swedish, Danish/Norwegian, German, French, Spanish, and Italian character sets accompany the standard U.S. ASCII. Options available by mid-year include sub- and superscript fonts and Code 39 and UPC bar codes.

The DP-9625A is sold by Anadex Inc., 9825 De Soto Ave., Chatsworth, CA 91311, 213-998-8010.

Reader Service ✓559

One Game, One Adventure

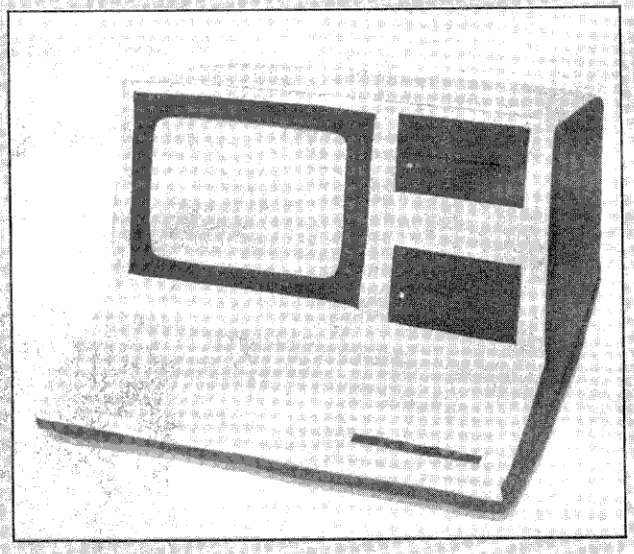
Treasure Run ($15.95 cassette, $19.95 disk) is a machine-language arcade game for the 16K Level II Model III. It features real-time action, sound effects, game pause, and joystick compatibility; the disk version saves the top 10 scores.

Eye of Mezron ($27.95 disk) is a 48K Model III text adventure. It also records the top 10 scores, and allows multiple game saves.

Both programs are sold by Janphil Software, P.O. Box 140, Kathleen, FL 33849, 813-858-6705.

Reader Service ✓565

DIFFERENT TRACK



Computer Clothes

There was competition this month—the anti-static wipes, the joystick simulator—but July's offbeat-item honors go to Computer Clothes, a cloth cover for the Model III that has cute disk drives and a screen appliqued to it.

Designed in authentic gray and black, the cover is advertised as sturdy, stylish, lint-free, washable, fully lined, permanent press, and safer than plastic covers that tend to accumulate static. Also, the "screen" serves as a frame for a 7-by-9-inch photo.

With 30-day guarantee, the outfit costs $35 plus $2 shipping and handling (New York residents add sales tax) from Home Works, 799 Broadway, Suite 325, New York, NY 10003, 212-982-2406. The New Products Desk never looked better.

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New Products listings are based on information supplied in manufacturers' press releases. 80 Micro *has not tested or reviewed these products and cannot guarantee any claims.*

If you guessed that a Practical Peripherals Microbuffer™ printer buffer saves time, you're right. For the way it works, this inexpensive product is the most practical addition to your microcomputer system ever.

With Microbuffer, you don't have to wait for your printer to finish before you resume using your computer. Data is received and stored at fast speeds, then released from Microbuffer's memory to your printer. This is called buffering. The more you print, the more productive it makes your workflow.

Depending on the version of Microbuffer, these buffering capacities range from a useful 8K of random access memory — big enough for 8,000 characters of storage — up to a very large 256K— enough for 256,000 characters of storage.

Practical Peripherals makes stand-alone Microbuffers for any computer and printer combination, including add-on units especially for Apple II computer and/or Epson printers. Each has different features like graphics dumps and text formatting besides its buffering capabilities. You can choose one that's just right for your system.

Best of all, they're built to last and work exactly like they're supposed to.

If you're still guessing whether you can afford to have one, talk with any computer dealer. That's the best way to find out how practical a Practical Peripherals Microbuffer is.

PRACTICAL PERIPHERALS

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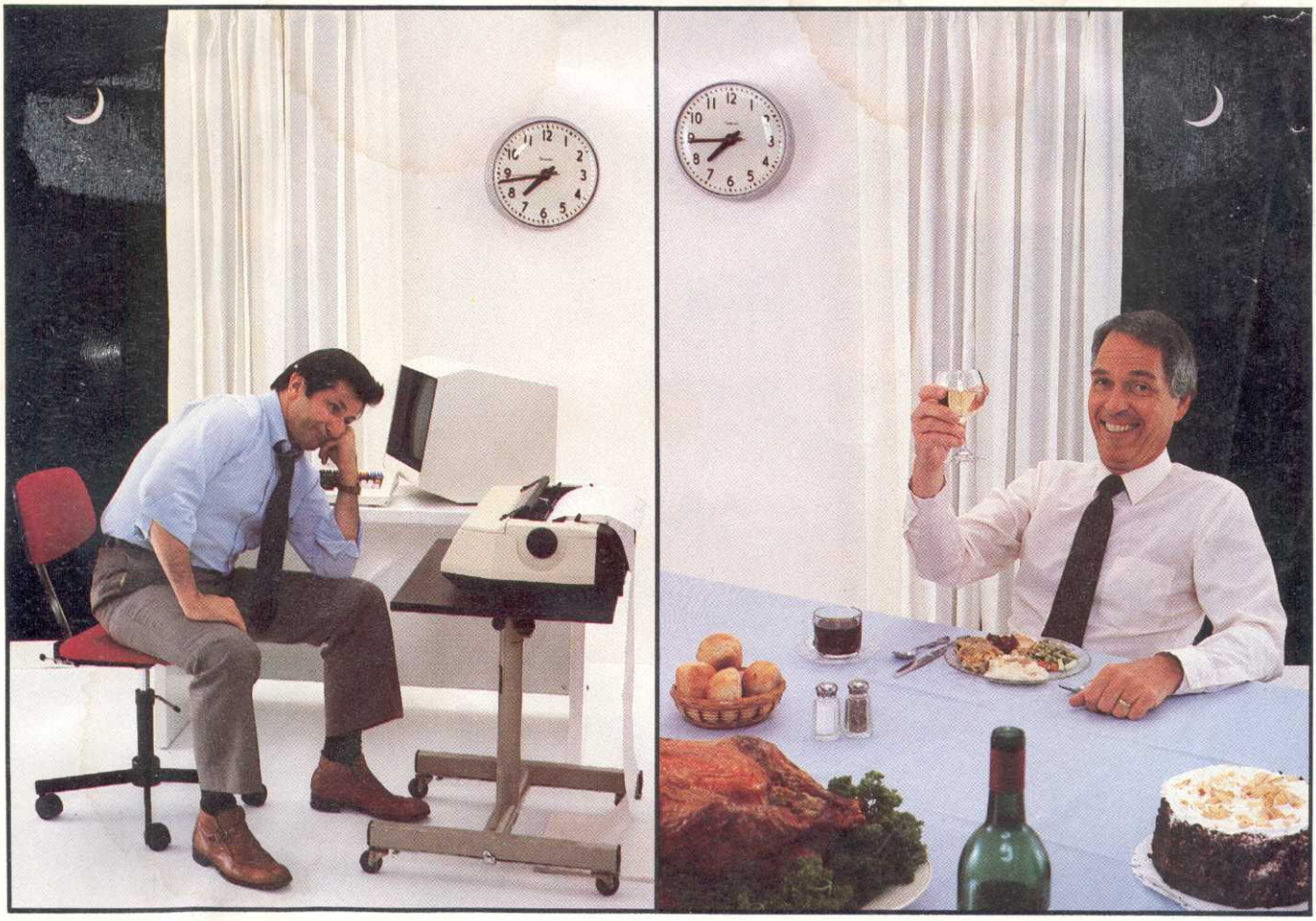
GUESS WHO HAS MICROBUFFER.™



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